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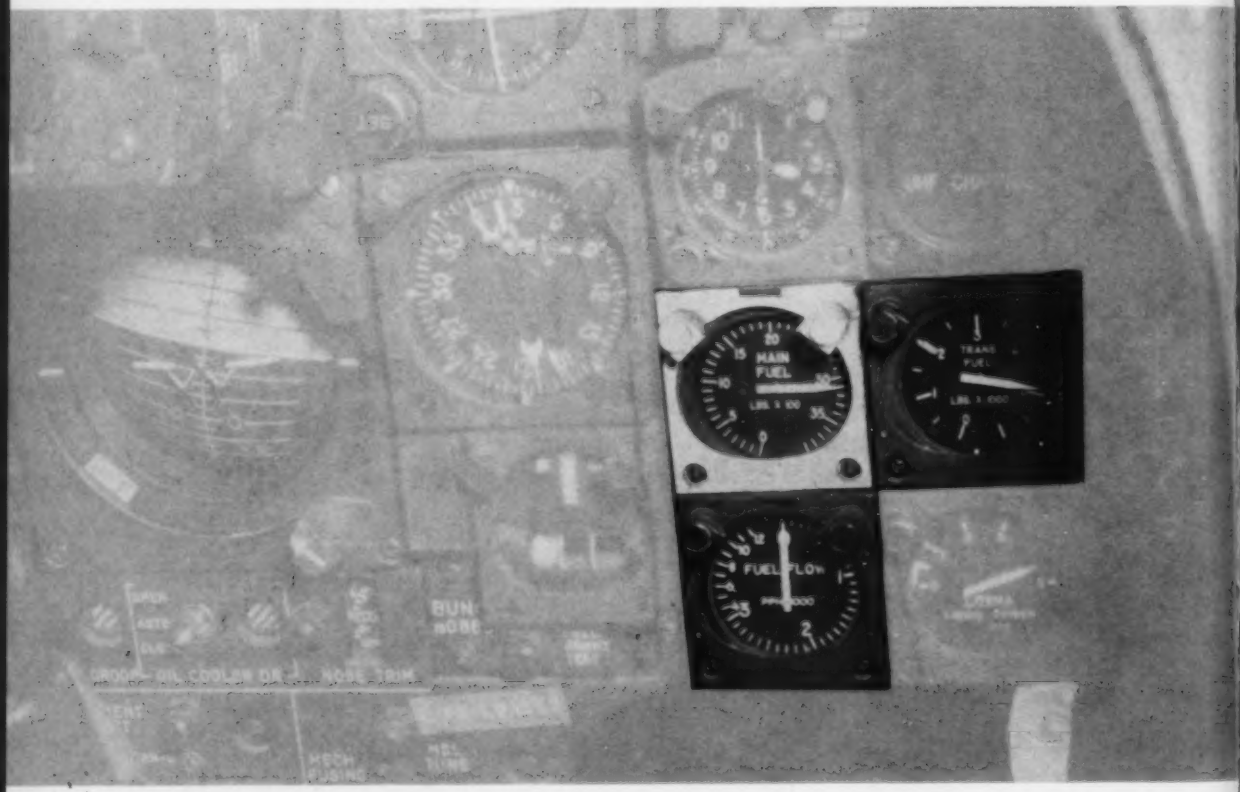
SCIENCE

By COL J.H. Reinburg USMCR

FUEL MANAGEMENT



It pays to understand those fuel gages.

Fuel economy is important but stretching one's endurance is not the way to save it. It is often a way to lose an expensive aircraft and endanger lives.

Modern tactical jets are configured to carry large amounts of fuel in the fuselage and the wings as well as in external drop tanks. As this fuel is consumed some of it must be shifted about the airframe to maintain the center of gravity within design limits. Such a fluid shift requires an intricate system of pumps, valves and electronic sequencing mechanisms. The degree of automation varies with different aircraft models and the pilot is the final link in the circuit. It would be nice if all the mechanisms were 100 percent reliable (this includes the pilot) but such is not true. Most of the mechanical systems can be checked by the pilot for their good (or bad) working order.

Most pilots are quick to detect fuel system malfunctions and get their birds quickly and safely back to the airfield (or carrier). Unfortunately, certain discrepancies defy or confuse pilot detection and an accident (or incident) results. Occasionally, a few pilots suspect malfunctions and do not realize the critical nature in sufficient time to get safely back to earth.

In combat, the situation is compounded by possible hits from enemy sources. Under certain circumstances quick pilot action can initiate clever fuel management for survival in spite of damage to the system.

Read the Proper Gage

A pilot in an F-8E was conducting daytime FCLP. He had successfully completed a first period of 10 bounces and a final landing without incident. After refueling for the second period, the first attempt to fire up the engine resulted in a wet start. After having the engine wiped out, the second attempt was successful. The aircraft was then hot refueled to an FCLP load of 3500-3600 pounds (2300 main and 1200-1300 transfer). During the initial bounces, the pilot noticed both fuel gages dropping at the same time. After the second bounce, the pilot moved the fuel transfer switch from *pump ON to pump OFF*.

Routine bounce drill continued until the low fuel level warning light came ON during the tenth pass just before the straight-in approach. At this time, the pilot ascertained that he had 1200 pounds registering on the main gage and about 500 pounds on the transfer system gage. This information was radioed on the tenth pass to the LSO, who then told the pilot to make it a final.

After the last touch-and-go, the pilot turned downwind for the final landing. Just prior to rolling the wings level on the downwind leg, the fuel boost pump lights came ON. Immediately the pilot informed the tower that, because of the uncertain fuel situation, he planned to make a precautionary approach. In the next instant, the pilot noticed the engine RPM and EGT reducing. As the RPM was unwinding past 65 percent, the pilot punched out safely and the plane crashed doing no harm in the area.

Subsequent investigation concluded that the accident was caused by engine flameout due to fuel starvation. This situation occurred as a result of the pilot misreading the fuel gages. He confused the fuel transfer gage for the main one and therefore did not realize the low fuel state. A contributing factor was lax supervision in that the preflight briefing did not emphasize the difference between the RF-8G and the F-8E instrument panels and fuel management of a partial fuel load.

Too Far on Too Little Fuel

A pilot was flying alone in a two-seater TF-9J on a maximum range IFR cross-country flight. When 192 NM from destination he had slightly less than 1000 pounds of fuel remaining. He was cruising at FL 370. At that time he was over an approved jet airport where he could have landed and refueled. His calculations convinced him he could reach the original planned destination with 300 pounds to spare. Idle power descent was commenced 130 NM out and upon descending through FL 240, he cancelled his IFR flight plan. Ten miles out at 5000' the pilot noted that he had *something less* than 250 pounds of fuel remaining. At this time he checked engine response by advancing the throttle. As soon as this movement made a normal registration of

85 percent RPM, he returned the throttle to IDLE. Three miles from the runway at 500′, the engine flamed out. While transmitting this information to the tower, he selected EMER fuel control in a futile attempt to stretch his flight to the runway. The pilot later stated that his gage indicated *slightly over 100 pounds* at the time of engine failure.

A clear field was slightly to the left of his nose so the pilot elected to crash land because he felt the altitude too low for the *Cougar's* ejection envelope. He walked away from the wheels-up, flaps-down landing.

This accident is a pure case of disregarding NATOPS General Flight and Operating Instructions by filing and attempting to fly to a destination with insufficient fuel reserves.

Correct Endurance Calculations

With VTOL capabilities helicopters have a better chance of survival when their fuel runs out. This makes fuel exhaustion no less forgiveable, however. Two young pilots filed for an authorized cross-country flight in a CH-46A. Their VFR flight clearance indicated that they carried exactly 3 hours of fuel and the flight duration was estimated at 2½ hours.

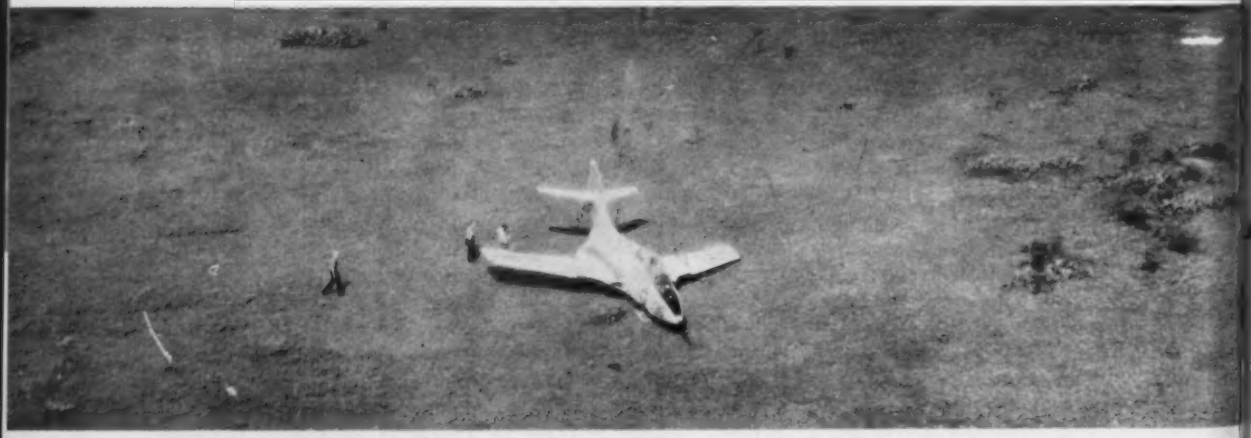
Their enroute calculations were bad but the endurance fuel estimate was precise. At the end of exactly 3 hours of flight, the engines quit from fuel starvation. At the time, they had just crossed over the destination airport's boundary and they autorotated safely to the ground about a mile short of where the tower operator had cleared them to touch down.

Since the aircraft was not damaged this narrative could stop here. But because of lack of proper flight planning on the part of the pilots, this potentially dangerous situation bears further comment. Forced landings in helicopters are not always as routine as this and when other people are aboard, there must be a high degree of responsibility exhibited for their safety. In this case three other crewmen were aboard. With better navigation and elimination of two orbits 10 miles out from the destination, the flight could have been completed according to plan.

Afterburners Have Voracious Appetites

An F-8C aircraft was being used for low level static longitudinal stability tests. After takeoff, the pilot proceeded to the assigned operating area where he got the program going by performing two military power runs to 600 KIAS at 5000′. During the second run, he used AB twice to evaluate the longitudinal trim change associated with AB ignition at low altitude and high airspeed. Completing the two runs, the pilot zoomed to 15,000′ and turned the fuel transfer pump OFF. At the same time, he noted a fuel quantity reading of 2800 pounds in the main and 500 pounds in the transfer system. Quickly thereafter, the pilot performed a diving acceleration run in AB pulling out at 4000′ indicating 680 kts. During the pullout, the pilot deselected AB and leveled off at 13,000′. Another diving acceleration run was made in military power pulling out at 5000′ and 660 KIAS. At this point the pilot was alarmed to see that his fuel registered 300 pounds in the main and zero on the transfer gage. The low fuel warning light had not illuminated.

This sudden massive reduction in fuel level caused the pilot to climb back to 15,000′ while reducing power to 83 percent and 2200 pph consumption rate. During the climb, the pilot pressed-to-test the low



A clear field was slightly to the left . . . so the pilot elected to crash land . . .

Without fuel, the flight path is down.

fuel light and it was satisfactory. Soon after he had transmitted his suspected emergency to Homebase Approach Control, the pilot noted all fuel gages had gone to ZERO.

Homebase was 60 NM away so the pilot requested information on possible closer airfields. Approach Control informed the pilot that he was about to pass over a suitable airport with a 5200′ concrete runway.

In view of the low fuel level warning light not illuminating, the pilot preferred to believe that his fuel gages had gone bad. Moreover, he had been airborne just under an hour and it was almost unthinkable that he had already consumed most of 8200 pounds (certified by the plane captain on the yellow sheet) aboard. Consequently, the pilot elected to continue to Homebase.

Thirty-two NM short of Homebase at 10,000′, the *Crusader* flamed out. The pilot deployed the emerpower package and was unsuccessful in a relight attempt. He transmitted his condition to Homebase Approach Control and punched out. He was unharmed in the parachute descent.

Since the aircraft was completely demolished, the exact cause of the flameout can not be determined. If, in fact, the aircraft had 8200 pounds aboard at the beginning of the flight, it would still have been possible to consume 9500 pph at low altitude, high speed maneuvers in and out of AB. There are two other possibilities. The airplane was not full at the beginning of the mission or fuel loss in flight due to leakage. The fact that the engine flamed out soon after the gages hit zero would seem to indicate that the beast was actually out of fuel and there was no apparent malfunction of the gages. Consequently, it would appear that the pilot was guilty of ignoring his fuel gages in the earlier part of his flight. The first reference he makes (in his report) to fuel readings is when the main was noted to be down to 2800 pounds. Low altitude operations in and out of burner is a high fuel consumption tipoff. The pilot had consumed 4900 pounds (by gage reading) in approximately 40 minutes. These readings gave a warning which was not heeded because the pilot then made two more test runs. A second chance in the form of the nearby 5200′ strip of concrete runway was also ignored and an expensive plane lost. It

Out of fuel and out of the *Skyhawk*.

simply boils down to poor fuel management.

Fuel Transfer Trouble Means Abort

Five *Skyhawks* were on a live ordnance ground attack practice mission. Besides ordnance, all of the A-4s carried 5400 pounds of fuel at light-off. No external tanks were installed. Soon after takeoff, Pilot X informed the others that his fuel quantity gage for the fuselage tank was indicating only 600 pounds and he was going to try selecting EMER TRANS. This did the trick in a little more than a minute by filling the tank to 4800 pounds. The pilot then turned the EMER TRANS switch OFF.

Pilot X considered his situation had returned to normal so he followed the flight to the target area. Everyone made three low-level napalm runs followed by two glide-bombing runs from 8000′. Upon pulling out of his second bombing run, Pilot X experienced a flameout. He informed the flight leader and attempted two relights while grabbing all the altitude he could glide up to. The relight effort sequence was in primary fuel, IDLE-CUTOFF, hitting the igniter and placing the throttle in the idle position. When both efforts failed, Pilot X pushed the throttle forward of idle. He then pulled the EMER GEN release handle extending the emergency generator, and switched to manual fuel. Then three more relight attempts were made in the following order: coming back to IDLE-CUTOFF, hitting the igniters and moving the throttle to IDLE; back again to IDLE-CUTOFF, hitting the igniters and moving the throttle forward of IDLE attempting a jam acceleration with no rise in RPM or EGT; back to IDLE-CUTOFF, hitting the igniters and placing the throttle slightly forward of IDLE. All this time, the RPM held at 60 percent and EGT at approximately 300°.

After the last unsuccessful lightoff attempt, the pilot made a normal and successful punchout at 3800′.

It would appear that the pilot should get a medal for so many relight attempts in such a short time, with so little altitude and speed available. Circumstantially, it appears that fuel was not getting to the engine due to failure of the fuel transfer system.

NATOPS directs that a pilot land as soon as possible when fuel transfer does not function normally. The Manual also directs that relight attempts be made in manual fuel for inflight engine malfunctions unless pilot induced.

In every case mentioned herein, there is no evidence of a malfunctioning *main* fuel gage. All of these accidents/incidents might not have occurred if the pilots had governed their flights according to main gage usable fuel readings. In essence, when bingo fuel registers, get into the nearest suitable airport posthaste before zero demonstrates its true meaning—nothing.

Wheels, Wheels, Wheels

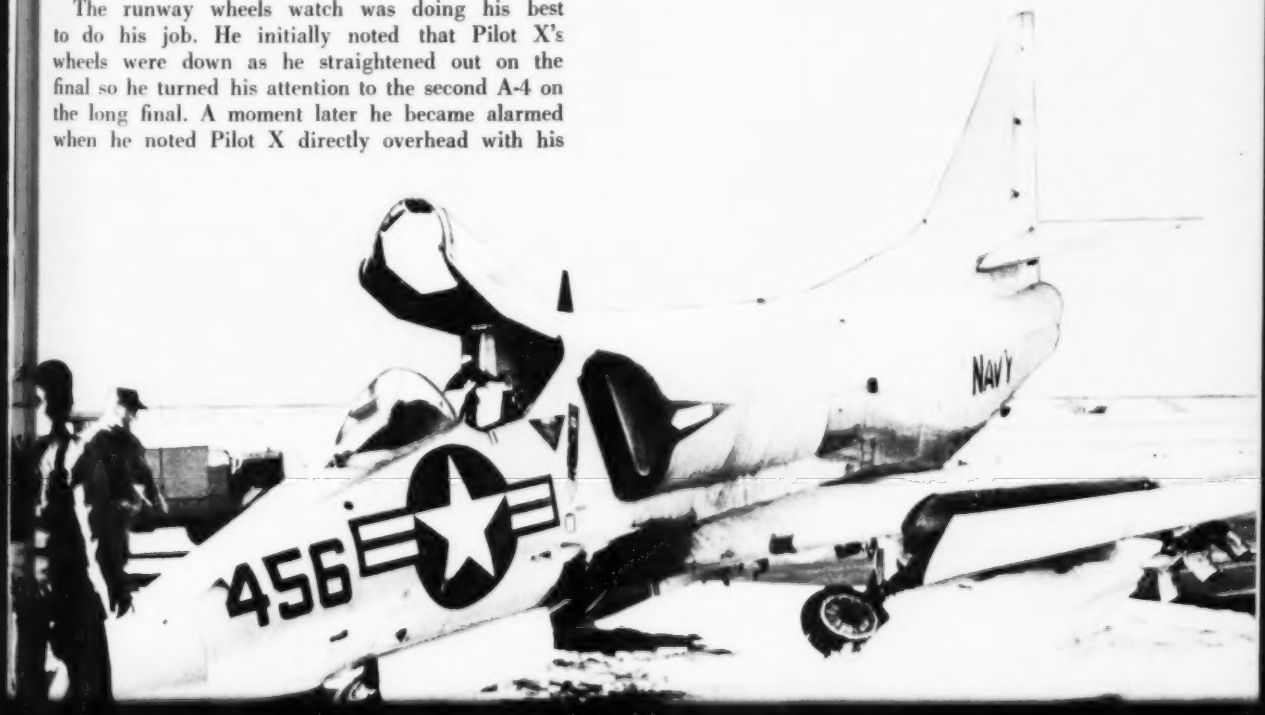
A division of A-4s was returning from a weapons hop. Pilot X led the tower-cleared break into the pattern. Landing checkoff lists were completed and Pilot X's landing gear was down as he turned from the downwind. Meanwhile, an aircraft on the runway had been cleared for an immediate takeoff, while a second *Skyhawk* was cleared to land from a long straight-in approach, presumably behind Pilot X. Upon straightening on to the final, Pilot X felt he might be too close to the aircraft taking off so he initiated waveoff procedures, adding FULL power and immediately retracting his landing gear. He did not inform the tower of his intentions; perhaps, because the air was cluttered with continuous conversation between the tower, the aircraft on the runway and the A-4 making the straight-in. As a good listener, Pilot X realized a few seconds later that the tower had suddenly changed instructions telling the aircraft on the runway to hold and the other *Skyhawk* to ". . . go around." Since his landing clearance had not changed, Pilot X continued his approach, reducing his power setting accordingly.

The runway wheels watch was doing his best to do his job. He initially noted that Pilot X's wheels were down as he straightened out on the final so he turned his attention to the second A-4 on the long final. A moment later he became alarmed when he noted Pilot X directly overhead with his wheels up. He waved his paddles but Pilot X had already gone by and before he could fire the flare gun the scraping had commenced.

Just prior to touchdown, Pilot X reduced power and saw the wheels lights flashing. It all came back to him as he hastened to push on FULL throttle. In a split second he also slapped the gear handle DOWN but alack and alas—, it was too late. The aircraft came to an ungainly halt on the nose and two halfway extended main mounts. No fire resulted and the pilot was unhurt.

Here is another example of habit pattern interruption contributing to a wheels-up landing. The wheels had initially and properly been extended. Then confusion on the runway or in the pattern motivated a waveoff. This was followed by a shortened landing sequence wherein the thing remaining paramount in the pilot's mind was that he had faithfully followed the NATOPS landing checkoff list. The change of plans happened too quickly to hope for help from the wheels watch or the tower. Moreover, since the two changes of plans were not communicated, voice help was understandably absent.

To avoid these embarrassing situations, pilots would be wise to always go over the entire landing checkoff list after any and all waveoffs. The May APPROACH had an article "Habit Pattern Interference" which relates to this trouble.



‘ Even Your

Ever since toothpaste and mouthwash came into existence, the Madison Avenue boys have been lining their pockets by emphasizing that there are some things "even your best friend won't tell you." Anyone who questions the veracity of this slogan need only recall when he last told someone to go buy a toothbrush. Society recognizes several items too personal and too embarrassing to call to the attention of the offender. Acceptable behavior is to endure rather than inform.

Flight safety also has its list of items too personal to mention, especially to one's seniors and particularly to one's commanding officer. Commanding officers are shown this deference not only by their subordinates, but by everyone else, too. This mode of conduct, while quite rational, can be a stumbling block to flight safety since the most important men in the Coast Guard flight safety program find themselves isolated from the outside world.

I first witnessed this "command isolation" more than eleven years ago. I was wearing one gold bar at the time just a year out of flight training; hardly fit counsel for myself, let alone anyone else. Six of my friends had lost their lives in six fatal training accidents, and I wondered at the time if anyone had approached their commanding officer about his attitude toward flight safety. He was one of the finest gentlemen you'd ever want to meet, but he'd say right out loud that he did not feel that the requirement to train combat-ready pilots was compatible with flight safety. I think he may have been a victim of the toothpaste slogan. I think he would have been very receptive to discussion, but no one would think of broaching the subject to him because he was such a fine fellow and after all, he was the skipper, wasn't he?

Since there is no practicable way to eliminate this social cocoon, one alternative is to expose potential officers to a sampling from the list of unmentionables. What follows is an attempt to illumine certain areas which do not lend themselves to discussion with commanding officers.

A commanding officer is never, but never, but never, reminded that his sincere interest and overt, enthusiastic support is the most vital and indispensable element in unit flight safety. If something this obvious eludes the one to whom it should be the most apparent, who will risk affront to inform the commanding officer that his lack of interest is detrimental to unit safety? You guessed it. Nobody.

Anyone skeptical of the tremendous importance of the skipper's interest in safety should consider that the captain is the pacesetter in all realms of unit activity. If he is big on administration, every directive and letter is worked over until it is worthy of Winston Churchill. If the captain doesn't sweat appearance, all hands look like ragamuffins; and, if the captain doesn't sweat safety, nobody sweats safety.

The second item, corollary to the first, is that the commanding officer demonstrates his commitment to safety through his example. By conforming to his own regulations and by showing respect for those promulgated by higher authority, he leaves no doubt that he means exactly what he says about safety. Actions speak with such a booming voice that mere words are masked in the thunder and yet, where is the man who will tell his commanding officer that he sets a poor example? That's right. His orders are yet to be cut!

The third area in which a commanding officer is not likely to be counseled is in the assignment and use of his flight safety officer. One of the reasons the commanding officer can have a solid safety program with a minimum investment of personal effort is that most, if not all units, have a trained safety officer on the staff of the commanding officer. Nowhere in the military is the staff concept more apropos than in flight safety, but to derive any benefit from the FSO he must be fully utilized. The FSO is similar to an airplane in that the more you use it, the better it works. But rob a few parts from your best plane, park it over in the corner, and see if you don't come up with a hangar queen.

Unless the unit is a relatively large one, the commanding officer may feel that his is one of the many units that cannot afford a full-time FSO. According to existing regulations, it is no crime to give the FSO other collateral duties, but doing so usually dilutes his effectiveness as a staff officer because he winds up with two bosses, the commanding officer

Best Friend...'

by LCDR Roger V. Millett, USCG

and his other immediate supervisor. This is against management principles which were understood as early as biblical times. The Bible is rather explicit on this point: "A man cannot serve two masters, for he will hate the one and love the other; or else he will hold to the one, and despise the other" (Matt. 6:24). I'll grant that the quote is taken out of context, but I feel that the injunction against two masters is just as valid when considering immediate supervisors or collateral duties as it is concerning God and mammon. Since much of the FSO's work involves research and produces no immediate, recognizable, tangible results, it is natural for the other boss to say, "you're not doing anything important, how about let's get this project out of the way." Do you think for one minute that the FSO is going to tell a senior that it is just as important to read the host of flight safety periodicals and other literature coming across his desk to ferret out the goofs, blunders, hazards, murphies, etc. experienced by others that could happen at this unit? No! There are many working-hour activities which are universally acceptable in the Coast Guard, but reading magazines is not one of them. So, rather than make a lengthy explanation about the experience of others as a positive safety factor, safety work will give ground to more "important" issues (i.e., to the other boss).

So what can a commanding officer do if it is necessary to assign a few more collateral duties to the FSO? There's not much he can do except be aware of the phenomena described above, be on the lookout for it, and accept an overall reduction in the unit safety effort.

A commanding officer may never be told about a fourth item which, owing to its subtlety, can escape the consciousness of those around him.

Organizationally, the FSO has the same vantage point as the commanding officer. That is, he is not involved in the operation of any section and therefore can make an objective assessment of what he sees. It only stands to reason then, that any safety item reported will be the responsibility of some other (the responsible) officer. There is a view, hopefully not prevalent, that when a safety item is discovered, the responsible officer should be given equal time to disprove the existence of said discrepancy; defend his honor so-to-speak. This idea is an almost-logical outgrowth of the time-honored practice of calling a safety item to the attention of the responsible officer for his comments and possible correction. But, note the difference between the first view and the practice out of which it evolved: the former admits to no discrepancy, while the latter not only admits to the possibility of error but provides the means to review and correct it.

The final area which is much too personal to discuss with a commanding officer is his attitude toward his unit, success and the status quo. Thinking one's unit to be pretty great is as natural as sticking up for your kids, but in both cases the heart is likely to be more influential than reason. A successful max effort operation is often accepted as proof that, "we've got this program wired, we're on the ball." And as the saying goes, you can't argue with success.

Or can you? Success leaves little doubt that you had a good unit in the past, but what about the future? You can hope your unit is successful, you can wish for it to be successful, and you can keep your fingers crossed, but past success is no guarantee of the future. Success is a threat if it fosters complacency. The only permissible attitude toward a good show is that there's always room for improvement; laurels are to look at, not to rest on.

For the benefit of prospective commanding officers in the audience, here's a fast summary of the items of which you will not be appraised as commanding officer:

1. The CO's active interest is the cornerstone of unit safety.
2. Example is more potent than verbosity.
3. Too many cooks supervising the safety officer weaken the safety broth.
4. Safety items are for review, not rebuttal.
5. Thinking your outfit is pretty good can be pretty bad.

Finally, if you think you may wish to consider any of these items in the future, you had better jot them down now, because after you're a commanding officer, "even your best friend won't tell you."

DOUBLE DOUBLE

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FLAMEOUT

Twin-engine tactical aircraft instill confidence in pilots by virtue of the fact that the extra engine appears to be foolproof insurance. Under noncombat conditions, aircrews feel assured that with good fuel management, they will always get home safely. The chance of a simultaneous double-engine failure is almost unthinkable. In combat, pilots flying twin-engine machines have the additional safe feeling that chances are slim for both power plants to be knocked out by enemy fire at the same time. This all adds up to more pilot efficiency and accurate ordnance placement.

Last year two F-4B aircraft experienced double flameouts immediately after takeoff. The facts of both accidents are quite similar and, therefore, are herewith related. The exact cause of the crashes cannot be determined because of meager wreckage recovery. The crews, however, survived, and have provided sufficient information to foster meaningful suspicions. Perhaps pilots with F-4B experience can derive other possible causes by reading these facts. Every source of help is being sought to eliminate the twin-engine mystery.

The pilot of the carrier-based *Phantom II* which crashed soon after launch had checked the yellow sheets and noted only a few discrepancies. The most noteworthy one was a no-fly downing gripe owing to the fact that the static correction would not engage. This had been corrected. The preflight went normally and things specifically checked were: intakes and compressor faces free of FOD; starboard throttle banana linkage bolts cotter-pinned; exhaust nozzles and turbines free from damage; nozzle actuator rods lock-wired. All pneumatic pressures were up and there were no static leaks visible. Aircraft turnup was normal and the engagement of static-correction resulted in only a 50′ altimeter drop. The takeoff checklist was completed and engine runup on the catapult was satisfactory in all respects.

The launch was normal and the gear was retracted when a pitch attitude of 10-degrees was attained after the cat-shot. At 170 kts, the flaps were raised to one-half and the aircraft accelerated quickly to 200 kts, at which time the flaps were fully raised. The flaps indicated full UP at 225 kts and about 1200′. This was reported to the RIO.

At 250 kts, 1500′, 10-degree nose-up attitude and military power, a violent explosion was heard and felt by the crew. Immediately, the RIO observed the variable inlet ramps to be fully retracted (normal). The pilot asked the RIO if it was the radar and realized immediately that it was too violent to have been the antenna banging the stop. Coincident with the explosion, the airplane began to decelerate and it felt as if the engines had stopped producing thrust. Suspecting a compressor stall, the pilot checked the EGTs and they read about 1000°. The throttles were reduced to idle and returned to the military position about one second later. At this point the pilot had to push the stick forward to maintain gliding speed. He also noticed that throttle movement going the full range from idle to military quadrant positions had not produced any noticeable change of thrust.

At the military power throttle position, the pilot scanned the instruments carefully to try and detect abnormal readings. There were no telepanel lights on, the master caution light was out, EGTs were 1000° for both engines, both RPMs were 100 percent, and fuel flow was 2200 pounds/hour for both engines with a gentle oscillation on one gage of about 100 pounds/hour. The nozzle positions were both slightly less than one-half opened. All other instruments were normal as they passed back down through 1500′. At this time both throttles were placed into the full afterburner position. This had no effect on the previous instrument readings and no additional thrust was felt. After 2-3 seconds in AB detent, the throttles were reduced to military. The pilot started a gentle port turn of 15-degrees angle

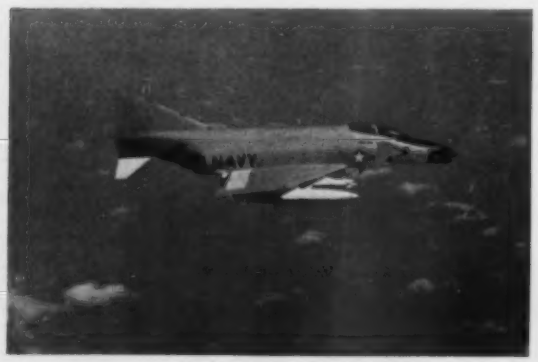
of bank, called the tower on CIC frequency twice, then switched back to departure frequency. By this time the aircraft was approaching 1000′ and the crew ejected successfully.

Since the aircraft was lost at sea, the specific cause of the accident will never be known. Consequently, it falls into the undetermined classification. The most probable cause was considered to be that the inlet guide vanes of both engines went to CLOSED because of one or more of three events: (1) explosion; (2) BLC ducting rupture; (3) engine bleed air check valve failure.

As a result of this accident, it has been recommended that the F-4 NATOPS model manager devise a procedure compatible with the carrier operating environment for a pre-launch check of the bleed air check valve.

Another *Phantom II* had similar trouble. Blastoff on the runway was normal, then after deselection of afterburners, the pilot noted a vibration when passing through 400′ and 260 kts. The pilot checked the position of the speedbrakes and saw they were UP, but noted that the landing gear was indicating DOWN and locked and the red warning light was illuminated with the gear handle UP.

At this time the aircraft was at 265 kts, 15 kts in excess of gear extension speed, so the pilot retarded both throttles to approximately 85 percent and raised the nose to assist in airspeed reduction. During deceleration the pilot noted that hydraulic pressures were good. While troubleshooting the landing gear problem, the pilot sensed the aircraft slowing rapidly and noted both RPMs had slipped lower to 75 percent. The pilot advanced the throttles to military; the engines, however, continued to slowly decelerate. The pilot then attempted an emergency airstart on the starboard engine. There was no engine RPM response to the airstart. The RIO had checked all rear cockpit circuit breakers while the pilot doublechecked the engine master switches ON during this phase. When it became obvious that the aircraft could not clear the terrain and the RPM had dropped to 70 percent on both engines the pilot ordered the RIO to punch out. The crew sucessfully ejected at about 500′ and 180 kts airspeed. The aircraft nosed over steeply and impacted in approximately two seconds. The elapsed time between the power loss and ejection was estimated to be about 15 seconds.



The pilot noted a vibration.

Possible cause of the thrust loss is a dual compressor stall resulting from: (1) cycling of auxiliary air doors; (2) snap deceleration at 265 kts with nose gear extended (disrupted airflow); (3) electrical sequencing malfunction during snap deceleration; (4) compressor corrosion; (5) a combination of the factors above.

The J-79 Engine Service Problems Conference of 30 November 1966 upgraded PPB 16A to "urgent action." ComNavAirSysCom stated that a bulletin would be issued when fix-kits became available. These kits should enable squadrons to combat corrosion buildup in the compressor section and provide the capability of maintaining the design compressor stall margin between overhaul cycles.

General Electric Company has undertaken a study of all F-4 double-engine power losses in an attempt to ascertain the seriousness of the stall problem and under what circumstances stalls would be most likely to occur.

The NATOPS Flight Manual for the F-4B has this to say about double-engine failure in flight:

"1. Extend ram air turbine to operate the left fuel boost pump at low speed. This will supply enough fuel to either engine for an airstart. WARNING: On airplanes prior to 152695Y without AFC 220 incorporated, maintain airspeed above 195 kts CAS to prevent the emergency generator pressure switch from disconnecting the emergency generator from essential buses. This would result in a complete loss of all electrical power, except for the engine ignition systems. On airplanes 152695Y and up, and all other aircraft with AFC 220 incorporated, the emergency generator will remain on the line down to approximately 90 kts KCAS.

2. Either Throttle—OFF

3. Other Engine—Initiate Airstart. To provide maximum fuel flow for an airstart, retain the throttle of the remaining engine in OFF.

4. If no start within 30 seconds, throttle—OFF.

5. Remaining engine-Attempt Airstart.

6. If neither engine can be started—Notify RIO and eject."

Avoid Those Ear Blocks!

By LT R.S. Case, MC

NAS Seattle

Recently, a few pilots and crew members have been reporting to sick bay because of that old nemesis, ear block. The majority of these cases are avoidable if you know *why* they occur and how to avoid them, so here's the straight skinny on the mechanics of this problem.

Air, being a free gas, expands at altitude, escaping from all gas containing spaces of your body—the most important of which is the middle ear. The middle ear is an air-filled space communicating with the atmosphere by means of a slim tube (the eustachian tube) which opens high in the back of the throat behind the nasal passages. A thin eardrum separates the middle ear from the outer ear.

On ascent to altitude the air in the middle ear expands, passing via the eustachian tube into the throat, maintaining a pressure in the middle ear equal to the outside pressure. Upon descent, as the external pressure increases, air must reenter the middle ear to maintain this equilibrium. If it fails to do so, the middle ear pressure becomes relatively negative and a pressure gradient across the sensitive and flexible eardrum produces a feeling of "plugging" or "fullness," or even pain—and if the pressure differential becomes great enough, rupture of the eardrum may even occur.

Why does air not pass freely *back* into the middle ear?

The opening of the eustachian tube in the back of the throat is so constructed as to produce a flap valve effect, enabling air to more easily exit the middle ear than to enter it. For this reason, when air must reenter the middle ear (as in descent from altitude), it may be necessary to voluntarily assist this process by such measures as swallowing, yawning, waggling your jaw, or even by pinching your nose and blowing against your closed mouth.

Why do you experience ear blocks only on occasion?

This depends on the patency of the eustachian tubes. If you have a cold, the tissue in the lower portion of the tubes may be swollen, effectively closing the opening and making it impossible for air to reenter the middle ear. This is the reason we flight surgeons have insisted you not fly with a cold—you *may* cause serious damage to your ear which though not irreparable, *could* necessitate your being grounded for a considerable period of time.

This also brings to mind a rumor I've been hearing on occasion—that breathing pure oxygen when experiencing symptoms of ear blockage during descent will help alleviate the problem. Don't you believe it! That would compound your problem, for should you become unable to "clear your ears" by the aforementioned measures, the gradual absorption of the oxygen from the middle ear by the surrounding tissues could only increase the pressure gradient across the eardrum, thereby increasing your symptoms. (See "O_2 Caused Ear Pain," p. 35, January 1967 APPROACH.) Nitrogen, which constitutes 79 percent of air by volume, is *not* absorbed by body tissues. Air is, therefore, better to have in the middle ear than pure oxygen. Use your oxygen in the proper manner, and not for ear blocks!

And remember, if you experience difficulty clearing your ears on a flight, or should your ears feel plugged for more than a few minutes following a flight, consult your friendly flight surgeon.

Short Snorts

Out of this nettle, danger, we pluck this flower, safety. - Shakespeare, Henry IV, Part I

Helicopters do not make good dilbert dunkers.

Helicopter Ditching

An SH-34J helicopter was cruising over an estuary at 400 ft. Airspeed was 70 kts with a power setting of 2450 rpm and 31" MAP. All gages indicated normal with 1100 pounds of fuel aboard. Suddenly, the engine made two pronounced coughs which, naturally, brought the crew to peak attention instantly.

Before the men could double check the instruments, the ailing power plant seemed to cure itself and run smoothly again. As a precaution, the mixture control was immediately placed in the AUTO-RICH position. Upon completion of this control movement, the engine again began to backfire.

Due to such a low altitude, there was insufficient time for a thorough diagnosis so the pilot turned toward the nearest shoreline, while the collective pitch was lowered. This action succeeded momentarily in holding the RPM at 2400 (apparent). For a brief period, the engine smoothed out and the pilot was able to build up some RPM by manipulation of the collective. While this was going on, the pilot found time to transmit a Mayday.

Realizing a forced ditching was now imminent, the pilot bottomed the collective and autorotated the chopper gently into the water. The rotor brake was engaged stopping the blades as the machine rolled over to the left. The crew exited safely and were quickly picked up by a boat. The aircraft sank out of sight in shallow water.

The helicopter was later salvaged and the engine checked for the trouble. Power loss was caused by the failure of number 5 piston boss which allowed the piston pin to separate from the piston and render its cylinder useless.

Such low altitude operations are normal for helicopters. Consequently, NATOPS emergency procedures must be committed to memory and practiced frequently. This crew knew their business and proved, once again, the value of being thoroughly prepared for this eventuality.

Brake Trouble Again

The pilot of an F-8A entered the home airfield landing pattern and upon lowering his wheels, he noticed a barber pole on the port MLG plus a red light in the gear handle. Recycling the gear did not change things. A visual check by a man at the end of the runway could only ascertain that the wheels apeared to be DOWN and LOCKED.

On the next circuit of the field, the pilot actuated the emergency pneumatic system to blow the wheels down. This eliminated the barber pole and red light, so he initiated his landing approach. Touchdown was on speed and at 90 kts the pilot initiated aerodynamic braking. Before touching the brakes, the pilot noticed the illumination of the low-pressure-warning-light for the hydraulic system. This motivated him to make a quick check of the brakes, and, as he suspected, the action was poor. Excessive pedal pressure was required to obtain any braking effect and the bad situation was quickly compounded by the collapse of the port MLG. With no support, the port wing tip quickly began to drag causing the *Crusader* to veer off the left side of the runway before it came to a halt. No further damage occurred.

BEWARE JET BLAST . . . Tail to tail at 80 ft. the jet blast of an F-8 turning up at 70 percent caused this damage to a C-47J.

Investigation indicated that the port MLG hydraulic actuator had failed. After replacement and wing tip repair, the airplane was on the line again, up for further flight.

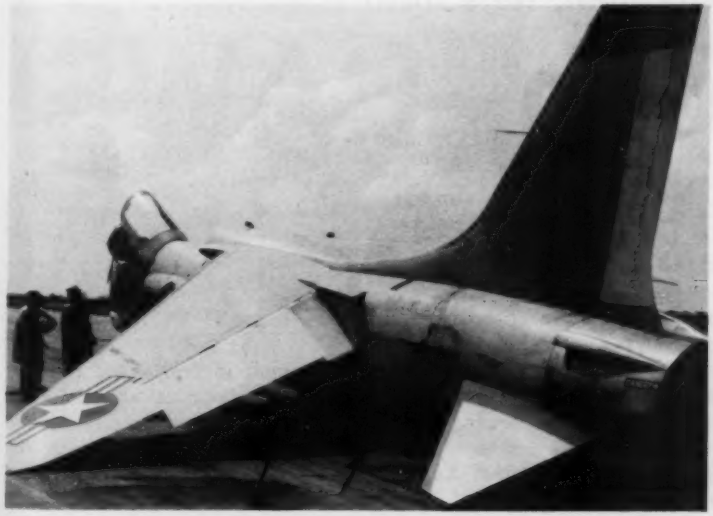
Runaway Gun

Aboard a carrier at sea a pilot manned his A-1H while the guns were being serviced. The ordnanceman discovered a loose solenoid assembly on the starboard outboard gun. He informed the pilot to withhold starting the engine because the entire gun would have to be removed. The man had hardly departed to get help when the gun started firing. The pilot was unable to stop it and the ammunition was exhausted harmlessly into the ocean.

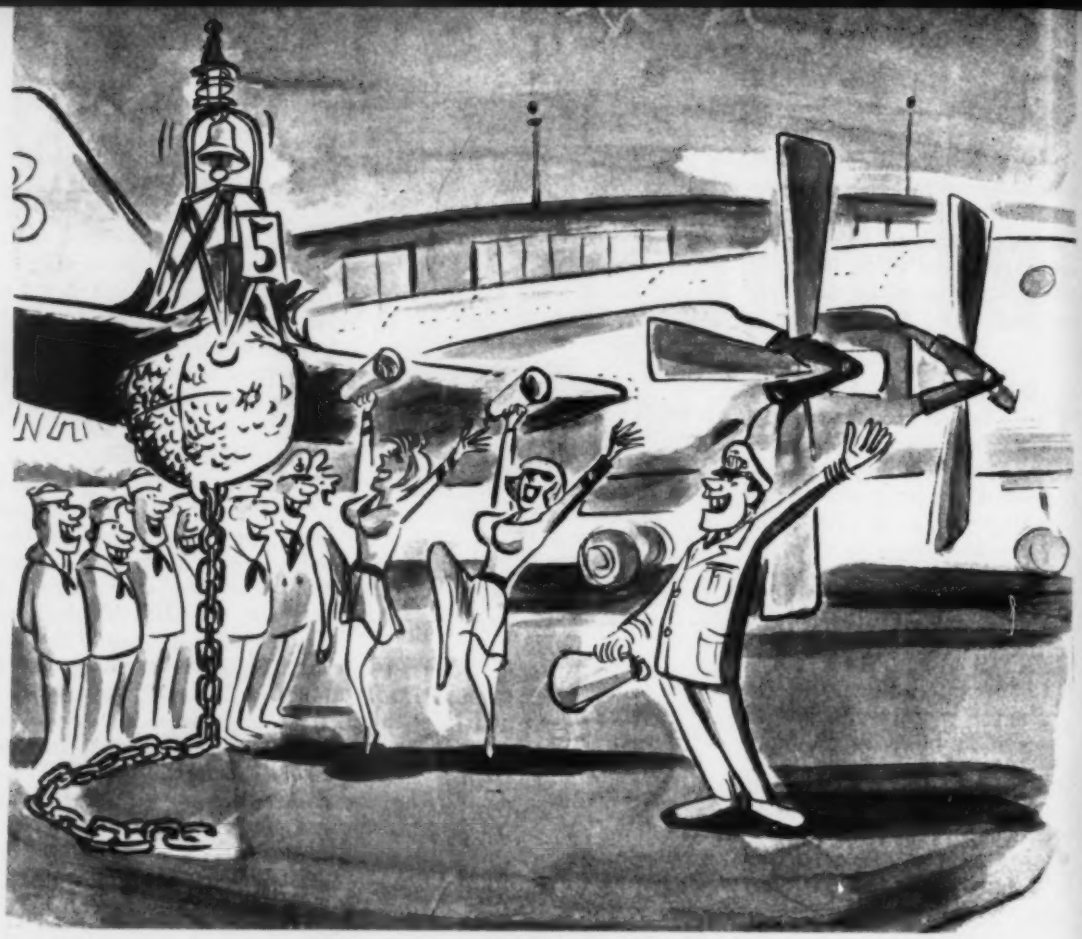
Subsequent investigation revealed all switches were on SAFE and no electrical power was applied to the aircraft. The gun charger was properly installed and lock wired. The hydraulic pressure had maintained the charging stud in the proper full rearward position.

The discrepancies discovered were: the hold-bracket was bent outward from the gun, the breechblock slides were cracked and the bolts holding the sear cover plate were loose. This allowed the trigger and sear to drop down and release the bolt. Rearward engagement to the charger stud was denied by the camming action of the breechblock and allowed the gun to runaway until all ammunition was expended.

Moral: Inspect those guns for misaligned parts, loose bolts and so forth very closely before loading them.



Damage looked worse than it was.



'Okay men, let's hear it:

Rah, Rah, RAWS!'

By John Christiansen, Jr.
P-3 Project Test Pilot
Lockheed Aircraft Corporation

RAWS (pron. like "Roger" with a mouth full of ham sandwich) is the newest electricity eater to join the P-3-for-lunch-bunch. It's a black box, designed to fill the memory gap that plagues the best of pilots, to wit: the separation between ship and salty water.

Since perfectionism can sometimes be as elusive as a bullfrog in mating season, we have had to take steps to enhance safety of flight for these low-level mission requirements. Result is the Radar Altitude Warning System.

RAWS is actually simple in design and required only a few test flights to optimize altitude index levels, eliminate nuisance warning actuations, and assure warning reliability. Prior to obtaining the final Engineering Change Proposal, a survey of several VP squadrons was made to see if pilots were receptive to having a noise maker and a red light-

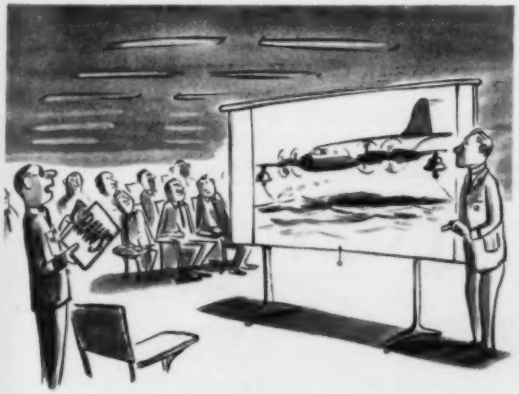
type low-altitude warning system. Unfortunately, it was like trying to sell a reduction in pay. Despite these solicited results, the powers that be decided that this system was necessary and should be integrated with the new APN-141 altimeter.

And we already have a testimonial from a pilot on a low-level night mission that he was able to write same only because of RAWS. It seems he became overattentive to a cockpit problem and if it hadn't been for the beeper and blinker . . . blub, blub.

The following is a summary of the permanent features of the RAWS installed by ECP 371. (It is retrofitted by AFC-71-P1, 9-13-66.)

1. The RAWS APQ-107 is installed in aircraft 5158 (BuNo 152718) and up, with retrofit provisions. This is a new installation in the P-3B which is the first fixed wing aircraft to use it. RAWS was first used for ASW helicopters to establish a positive reference for hover altitudes during ASW sonar operations. The RAWS system consists of a single box located at the bottom of Bay 44, forward RH electronics rack, and operates in conjunction with the radar altimeter which provides warnings under the following conditions:

a. High Index—When the aircraft is descending through the high index, which is currently set at 380 ±10′, the RAWS warnings will occur for a duration of approximately three seconds, then cease. Its function is to give the first warning of approaching low altitude. No warning is given when ascending through this high index setting. The reason for using 380′ is twofold. (1) the voltage analog scale from 0-400′ is 20 MV/Ft. and from 400-500′ is reduced to 2.6 MV/Ft. The Millivolt changeover causes a slight deadband around the 400′ mark which would cause too wide a tolerance in the index setting. (2)



"Raws is quite simple in design . . . or, not quite that simple, Ensign!"

"Pilot to TACCO, anticipate mission conclusion in 10 seconds. . ."

At 200 KIAS and a 5-degree dive angle, a pullout can be achieved from this index warning losing only 200′.

b. Low Index—When the aircraft is at or below the low index, currently set at 170 ± 10′, the RAWS warnings will occur as long as the aircraft remains at or below 170′. Its function is to warn the pilot of very low altitude in case he accidently lets it slip while concentrating on the problem. Lower index settings were tested. For instance, using a 100′ level (one wing span) I found that any rate of descent through this level could easily develop severe water leakage in the airframe. The 170 index provides a 200′ clearance between the high and low setting plus a little more advantage of safely arresting an unsolicited rate of descent.

c. Unreliable Altimeter—A RAWS warning will occur as long as the altimeter remains unreliable. This is a quick way to get the pilot's attention to the unreliable condition.

d. Power Failure to Altimeter—RAWS warnings will occur as long as the power to the altimeter is off. This warns the pilot that some part of his radar altimeter system is not functioning properly.

2. The RAWS warnings consist of both a pulsating (two per second) 1000-cycle audio tone and the red glare shield lights blinking in synchronism with the tone. The audio tone in the head sets cannot be selected off nor can the volume be altered by the crew. The tone will be heard in the speakers if the speakers are selected. Only the pilot and copilot receive the RAWS warning.

3. RAWS warnings are inhibited under the following conditions.

a. Nose gear, down-and-locked. Thus no nuisance RAWS warnings are given at takeoff, approach, landing, or when on the ground. All RAWS warnings are inhibited.

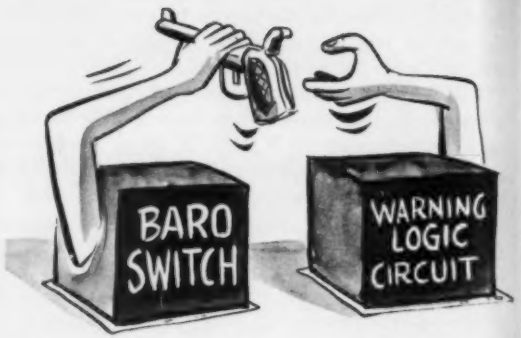
b. Flap handle in the APPROACH/TAKEOFF or LAND position. This delays RAWS activation at takeoff; in most cases the aircraft will be above 160′ by the time the gear is up and the flaps are brought up. Also in case of ditching with WHEELS UP, the RAWS warnings are inhibited when the flap handle (not actual flap position) is in the APPROACH/TAKEOFF or LAND position. The RAWS system is fully "armed" with the flap handle in MANEUVER or UP position.

c. Reliability warning is inhibited by a barometric switch in the RAWS unit when flying above a reference pressure altitude. This is necessary to prevent nuisance warnings when flying beyond the range of the altimeter (above 5000′) where the altimeter normally becomes unreliable. Power fail warning will occur.

4. Facts concerning the barometric switch in the APQ-107 RAWS unit.

a. The baro switch is a differential pressure sensing device, one chamber of which is plumbed into the copilot's static system. The other (reference) chamber can be vented and resealed by removing and reapplying RAWS d.c. power. Thus, the baro switch reference altitude can be set.

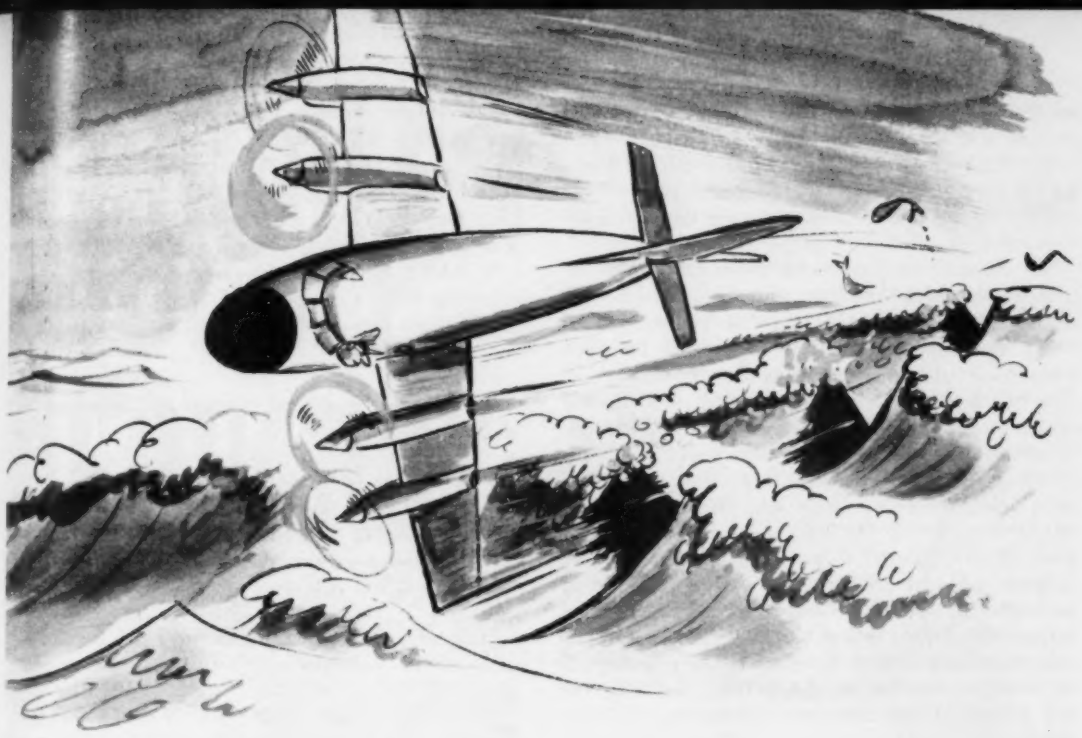
b. The baro switch operates when the aircraft reaches a pressure altitude of approximately 800′ above the reference altitude. The reference altitude is automatically established on the ground when power is removed and reapplied to the aircraft during normal ground operations.



c. When the baro switch operates, it arms the warning logic circuit. However, this circuit will not inhibit the warning input to the gate generator until the radar altimeter is actually unreliable. By design of the RAWS system, the HIGH and LOW ALTITUDE INDEX WARNINGS are routed through this warning logic circuit. Therefore, the low altitude warnings, as well as the unreliable warnings, cannot be given if *both* the following situations exist simultaneously:

Baro switch is operated;
Altimeter is unreliable.

The operational significance is this:



"Lower index settings were tested. . ."

a. If the aircraft takes off from a field near sea level and in a high atmospheric pressure area, then flies to an operations area where the atmospheric pressure is low, the baro switch will see a significantly higher altitude than that actually flown. Under these conditions, the baro switch could operate at an extremely low altitude, thus arming the warning logic circuit.

b. Under the conditions of a. above, if the altimeter goes unreliable, no low altitude or unreliable RAWS warnings will occur.

c. Under the conditions of a. above and the altimeter remains reliable the normal low altitude warnings will occur. If, however, the altimeter goes unreliable the conditions of b. above apply.

d. Because of the above condition, it is suggested that the baro switch be reset by the crew by pulling the RAWS d.c. circuit breaker for about 10 seconds then resetting. This should be done at an altitude of 1000′ or 3000′ after takeoff or when arriving at the operations area. Thus, it is assured that the baro switch will be open and all RAWS warning capabilities will be enabled for low level operations. The baro switch will still be able to inhibit the unreliable warning when exceeding 5000′ radar altitude.

Also, it should be noted that any time the gear is cycled, or the flaps are cycled beyond the maneuver position, the RAWS a.c. power is interrupted; consequently the baro switch will be automatically reset. In order to eliminate possible nuisance warnings this situation will be corrected by ECP action in the near future. The ECP is 1653 effective on P-3s from serial no. 5239 and up (production models); August, 1967. Ships prior to 5239 will be retrofitted.

A design change affecting the origin of the voltage used to reset the RAWS baro switch has been incorporated by NAF-1, the designers and manufacturers of this GFE unit. The change is effective with units starting around serial number 190 and up. The earlier units will be retrofitted in the future.

Instead of using external d.c. to control the baro switch reset function, the required d.c. is now developed from within the RAWS unit in serials 190 and up. This means that any time the RAWS a.c. is interrupted, the baro switch will be reset.

Paragraphs 4.a. and 5.d. above are affected when RAWS serials 190 (approximately) and up are installed in the aircraft. The change is as follows:

(a) The a.c. RAWS circuit breaker must be pulled and reset in order to reset the baro switch to a new

reference altitude. (The RAWS d.c. is still used to provide self test operation.)

(b) No change to aircraft wiring or RAWS warnings is made.

(c) The old and the new units are directly interchangeable.

(d) Summarizing, as long as the radar altimeter is reliable, the high and low altitude warnings will occur regardless of the baro switch status.

(e) The power-fail RAWS warning will be given regardless of the baro switch status.

5. Self-test feature allows for testing the RAWS system at any time either in flight or on the ground. A spring-loaded RAWS test button is located adjacent to the RAWS d.c. circuit-breaker at the forward load center in the cockpit. When depressed, the RAWS warning (flashing lights and audio) will occur if the APQ-107 is operating properly.

When on the ground, the RAWS test button performs the necessary switching to activate the system. In flight, under certain conditions (baro switch operated and altimeter unreliable), there will be about a four-second delay from the time the test button is depressed to the time the warning occurs.

6. There are no crew operated controls other than the self-test for the RAWS. The system can be deactivated only by pulling the RAWS a.c. circuit breaker located on the forward load center panel or by lowering the gear or flaps.

7. Preflight checks:

a. Depress RAWS test button on forward load center panel. The red lights on the pilot and copilot glareshields shall flash in synchronism with the 1000-cycle audio tone heard in the headsets (or speakers if selected).

8. RAWS operating power is derived from the following fuses:

115 V single phase essential a.c.	monitorable
28 V d.c.	monitorable

9. It should be pointed out that the high and low altitude index settings can be adjusted. The range of adjustment in the RAWS equipment for the APN-141 altimeter system is as follows:

High index—Adjustable from 1000 to 3000′

Low Index—Adjustable from 25 to 300′

Naturally, squadron personnel will not be allowed to adjust the presently approved levels. If for some reason a change is desired (and the reason had better be a good one) the NavAir Systems Command, I'm sure, will be more than happy to hear the pros and cons.

The system was proved to be extremely reliable and definitely an asset to the P-3 list of black boxes. Used properly and with confidence, it stands alert to save your hide and an aircraft for Uncle Sam.

"The system was proved to be extremely reliable. . ."

DOUBLE JEOPARDY

Hypoxia and hyperventilation were both factors in an RF-4C incident recently reported. The pilot systems operator (PSO) in the rear seat took off his oxygen mask, became hypoxic and passed out. In his concern over the situation, the aircraft commander (AC), hyperventilated to the point that he was unable to land on his first two attempts. It all ends happily but there's a lesson here just the same.

The RF-4C took off on an aerial reconnaissance and navigation training mission. On completion of the low level portion of the mission, the pilot climbed to FL 300 to rendezvous with another RF-4C before proceeding to recovery base. During the climb the PSO made a radio report and shortly afterwards, while the aircraft was in a holding pattern awaiting join-up of the other aircraft, removed his oxygen mask to wipe his nose. After wiping his nose, he cleaned his glasses and proceeded to tidy up the cockpit a bit.

After approximately 15 minutes at FL 300, the AC asked the PSO if he wanted to fly awhile. No answer.

The AC adjusted the rear view mirrors. No PSO.

At this point the AC banked the aircraft and rocked the wings to see if he could get the PSO's attention. After this action he looked in the mirror and saw the PSO, his head leaning against the canopy . . . unconscious.

The AC immediately commenced a descent to a lower altitude toward home field and called Mayday to radar control. *At this time he noticed that the emergency vent knob was out.* He pushed it in and the cockpit immediately began to pressurize. The cabin pressure altimeter reading of 28,000′ started to decrease rapidly as the cockpit pressurization increased.

During descent the AC placed his emergency oxygen lever to the emergency position and then related the nature of the emergency to the radar controller. When descending through 10,000′, the AC saw the PSO raise his arms against the canopy. Later the PSO stated that he recalled hearing radio transmissions at approximately FL 250 indicated altitude and that he connected his oxygen mask at about FL 200. He did not, however, go to 100 per cent oxygen until descending to 4000′ when the aircraft was handed off to approach control.

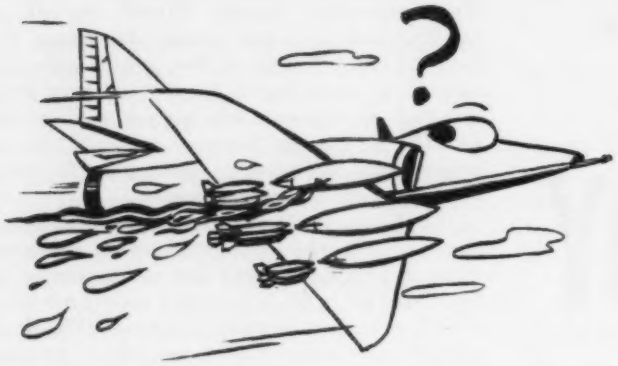
The AC requested an expeditious straight-in recovery. At this time the aircraft was at 1500′, seven miles on final, left of centerline which was too close for a hand off to GCA. Approach control advised the aircraft to contact the tower if he was VFR. He then switched to tower frequency but had to go around as he was not aligned with the runway. On the second approach he made a close-in box pattern but overshot the turn to final and went around again. He later stated that during this approach he realized he felt dizzy and was becoming disoriented. In his anxiety he had been breathing hard and rapidly on 100 percent oxygen. Removing his oxygen mask, he held his breath with the result that he began to handle the aircraft in a normal manner. The aircraft was landed without further incident and the air crew was taken to the dispensary.

Investigators assigned the primary cause of the incident to pilot factor in that the AC failed to follow the pre-engine start checklist in sequence outlined and consequently did not insure that the emergency vent knob was in. The AC states that the crew chief's activity in the cockpit while standing on the aircraft ladder caused him to check items out of sequence. This resulted in his failing to notice that the emergency vent knob was out. In this situation the cockpit pressurization and airconditioning are shut off and the crew breathes ambient air when oxygen masks are removed.

"Other air crew factor" is listed in the incident report in that the PSO failed to heed oxygen discipline and did not inform the pilot that he was removing his mask and became hypoxic due to lack of cockpit pressurization. "Air crew factor" was assigned because the cruise/level-off checklist was not accomplished.

The report recommends that supervisors and briefing officers of jet aircraft flying activities frequently emphasize checklist discipline and air crew coordination related to the physiological aspects of flying.

Faulty Practice Bomb



On a close air support mission in an A-4E, I commenced a 10 degree napalm run on a practice target. When I pickled the Mk-77 firebomb, I felt the initial jolt of the ejector cartridge, then a secondary jolt immediately after the first which rocked the starboard wing up more than I expected. Upon release of the bomb, the FAC observed a white puff of smoke under the aircraft. The flight leader also observed a puff of black smoke in the path of my aircraft. No bomb impact was observed. The flight leader checked me over and observed a small hole in the bottom of the starboard drop tank with discoloration trailing aft. My aircraft was configured with 4 Zunis on station 1, empty drops on stations 2 and 4, 3 Mk-81s on station 3 and the Mk-77 firebomb on station 5.

After an uneventful landing, inspection revealed that the igniter body had hit the tank causing a ½-inch hole. The igniter apparently broke up depositing white phosphorus on the tank which burned when exposed to the air.

I didn't realize that the possibility of a fire existed until the crash crew requested that I shut down the aircraft. I noted fuel dripping from the tank and the phosphorus was smoking at the time and continued to do so for several hours.

The actual cause of this incident is still undetermined. However, if it ever occurs again I believe the drop tanks should be jettisoned immediately to reduce the fire hazard and possible loss of an aircraft.

Night Helo Confusion

Five SH-3 helicopters were enroute back to their carrier at night. When they were almost home, the weather deteriorated, requiring a quick switch over to IFR approaches. Number three aircraft in the daisy-chain pattern reduced flying speed to 40 kts so as not to overrun number two. The copilot was flying the helo making every effort to stay VFR and see number two. Fortunately, the plane commander was properly performing the copilot role for IFR flight, and when he observed the radar altimeter indicating lower than 150′, he yelled for more power and altitude. Response was adequate and descent was checked at 100′ above the water. A successful IFR landing concluded the incident.

This near miss points out, once again, the dangers of the pilot attempting both modes of flight (VFR and IFR) simultaneously. Moreover, it is a vivid demonstration concerning the importance of radar altimeters plus an alert copilot. During such low altitude IFR helicopter operations it is imperative that the pilot at the controls keep his eyes glued to the instruments while the copilot divide his time between cross-checking the instruments against each other and any possible visual sighting.

VFR Penetration

Leading a section of two *Skyhawks*, I had my wingman in extended column behind me as

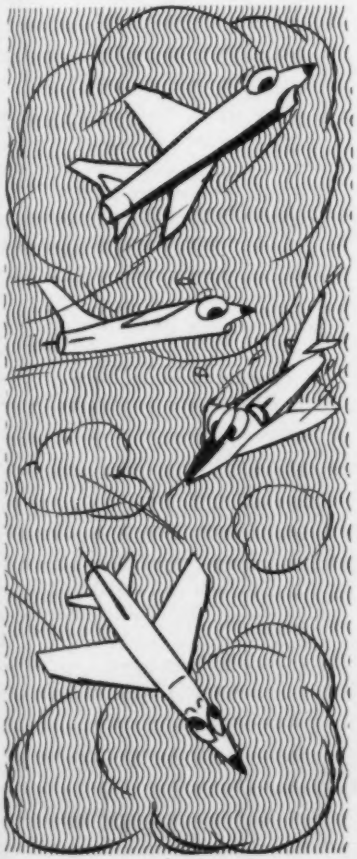
ANYMOUSE

The purpose of an Anymouse (anonymous) Report is to help detect or prevent a potentially dangerous situation. They are submitted by Naval and Marine Corps aviation personnel who have had hazardous or unsafe aviation experience. As the name indicates these reports need not be signed. Self-mailing Anymouse forms are available in readyrooms and line shacks or through your ASO. All reports are reviewed for appropriate action.

— REPORT AN INCIDENT, PREVENT AN ACCIDENT —

safety monitor while I flew simulated IFR. The weather was CAVU. Approach Control cleared me for a jet penetration and to maintain VFR at all times.

Just after passing FL200, approach control informed me of the presence of aircraft, six miles away at 12 o'clock, closing, altitude unknown. I was unsuccessful in locating the bogey but eye straining also revealed the presence of a solid haze level reaching up to about 10,000′. Continuing my descent I was annoyed to report several "no joys" to ground radar. Upon entering the haze, approach control radioed that the bogey had closed the gap to two miles, altitude still unknown. A few seconds later the message was "one mile and closing" and I was getting alarmed at my continuous "no joys."



In a few more seconds I had a real scare upon seeing a formation of three aircraft about to collide with me. Fortunately, they were better able to take evasive action. Number one and three split apart to get around me. Before I could alter my penetration dive, the formation rejoined and calmly passed out of sight in the haze, I blinked my eyes, swallowed hard and completed my penetration practice.

In retrospect, I have concluded that a VFR jet penetration means just that. . . !

Hard Head Minus Hard Hat

One of the things that must strike fear into the heart of every helo pilot is the situation where he is strapped in, the blades are turning, and people are milling around his flying machine where he can't see them.

I had just completed a helo ferry flight and was awaiting transportation for my crew when one of those slick SH-3As came into sight and began a straight-in approach to the taxiway leading to the ramp area where we were parked. As he began his transition into a hover the downwash of his rotor threw various items of debris into the air. In order to avoid FOD, he broke off his flare, moved farther down the taxiway, and made a routine landing. However, it appeared that the pilot was concerned that he might have received some damage to an engine for a crewman was sent out of the aircraft and up the port side while the aircraft remained turned up and parked in the middle of the taxiway.

I was standing about 100′ away and directly opposite the left side of that helo when the crewman, standing on the steps in the side of the aircraft, reached up and unlatched the left engine nacelle and swung it down. He then proceeded to crawl out on the work platform (the nacelle) on all fours. After looking at the side of the engine, the crewman straightened his arms to look (presumably) at the upper area of the engine. His head-to-blade clearance hadn't been much to start with, and this move used up the remainder in a split second. His head snapped downward as my ears heard a distinct "thock." The crewman pitched forward on the work platform and came to rest with his head and shoulders over the forward edge. He remained there only momentarily and then backed up and off the platform, climbed down the side of the helo, and walked clear holding his head with both hands. He didn't have a hardhat on.

The crewman walked over to a C-1A crew (they too, had seen this show), sat down briefly as they tied a field dressing over his bleeding head, and chatted briefly with them. The SH-3A's rotors were, by now, stopped. He then returned to his aircraft and within about five minutes was acting as the signal man for the turnup prior to its departure, even though he should have been a patient in that very machine (there was another aircrewman who could have taken over the remaining duties). The SH-3A turned up, our lucky friend climbed aboard, and they departed.

When we all were able to think, speak, or close our gaping mouths, we realized that we had seen perhaps the best training lecture and the least costly one any of us could hope to witness. It was a great upset in the usually one-sided contest between rotors or props and a human body.

Reader Questions & Headmouse Answers

Have you a question? Send it to Headmouse, U. S. Naval Aviation Safety Center, Norfolk, Virginia 23511. He'll do his best to get you and other readers the answer.

Wonder Where the Oil Went?

Dear Headmouse:

Information is desired which may involve safety factors concerning F-8 operation:

1. On the Bendix AJH-4 fuel control the maximum and minimum adjustment marks should be identified as to which is which. Most of us have learned one from the other but a newcomer can become confused. This is true even after being shown time and time again.

2. To counteract salt spray and/or sticking afterburner nozzle flaps, we use a mixture of silicon and Moly B. But this is only good for a short period. Is there a better lubricant for this purpose?

3. We service our CSDs every day when flying and many take oil. Where does the oil go in this self-contained system when there are no noticeable leaks?

ADJ3 G. V. SMITHSON, VF-13
FPO NEW YORK

▶ Your suggestion of a more positive means of identifying the maximum and minimum adjustments on the Bendix AJH-4 fuel control is well taken and will be brought up for discussion during the next PIP (Product Improvement Program) conference involving the J57. In the meantime, try to remember the bottom screw on the back of the fuel control is the MAX rpm adjustment; the top screw is the IDLE rpm adjustment. In both cases, turning clockwise increases RPM; turning counterclockwise, decreases RPM. Some of the sharper operators put a placard with this type information for each model fuel control inside the lids of their trim boxes. Might be a good idea to follow this practice.

Concerning afterburner nozzle flap lubricants, some operators report satisfactory results with collodial graphite DGF-123. Others report a preference for molybdenum disulfide powder lubricant Mil-M-7866A, FSN 9W-6810-264 6715. The internal cylinders are lubricated with Easy Off 990 which is baked on during PAR.

As to where the oil goes in what appears to be a self-contained system, the air pressure regulator controls pressurization of the CSD reservoir and transmission case to 10 (± 2) psi above ambient pressure. If due to rapid temperature or altitude changes, system pressure rises to higher values, the regulator relieves system pressure at 13 psi and limits maximum reservoir pressure to 18 psi. The regulator has an overboard vent and it is possible for oil to vent overboard when these conditions occur. If excessive oil is required it may be well to check for a faulty air pressure regulator. Figure 2-36, NavWeps 01-45HHD-2-4 refers. Some loss of oil is normal so the practice of replenishing CSD oil daily after flying is a good one —most CSD troubles are due to underservicing.

Very resp'y,

Headmouse

Unlike the flight control systems on present day high performance aircraft—the Naval Aviation Safety Center desires a continued feedback.

Has information in any Safety Center publication ever helped you to prevent an accident, avert an injury, or deal with an emergency in a better way?

If so, and you have not already informed the Safety Center, it is particularly desired and important that you do so. Such feedback is vital to all departments at the Center and for fiscal support of our safety research and education program.

Dual Visor for SPH-3

Dear Headmouse:

While helicopter night operations are in progress, the pilot's eyes are endangered by flying dirt and debris due to the fact that the SPH-3 helmet does not have a clear visor. It is recommended that either a clear visor be procured for this type of helmet or, preferably, that a dual day and night visor arrangement such as the SPH-6 be designed for the SPH-3 helmet. Night operations both in ConUS and overseas would then be much less hazardous for pilots who possess this type of helmet.

CAPTAIN P. S. MAKOWKA
HMMT-301

▶ The Aviation Supply Office advises that an evaluation quantity of SPH-3 helmets with dual visors is being procured. Evaluation results are expected to be favorable and an early buy is anticipated. However, SPH-1 helmets must be deleted from the supply system first.

Very resp'y,

Headmouse

E-15/E-27 Capability, Same

Dear Headmouse:

On page 25 of the March issue, the picture caption in the upper right corner states that the E-27 has a maximum engaging speed at 50,000 lbs—124 kts. The reference given is Aircraft Recovery Bulletin 43-12C. A careful study of the bulletin shows the E-27 has the same capability as the E-15, that is 50,000 lbs at 136 kts.

Please clarify. Several squadrons have called me on this as I had previously told them that the E-15 and E-27 had the same capability.

D. L. ELAM
AVIATION SAFETY OFFICER
MCAS BEAUFORT

▶ Safety Officer Elam was promptly notified by telephone of the following information which is passed on for the benefit of others:

You are correct. Current E-15 and E-27 aircraft recovery bulletins contain identical aircraft engaging speed limit charts. The test program for E-15 gear has not been completed. Therefore, the E-15 gear is limited to the E-27 gear capabilities. A revised E-15 bulletin will be published when the test program is completed. For now both captions should read:

Max engaging speed at
50,000 lbs—136 kts

Very resp'y,

Headmouse

Charred Cork

Dear Headmouse:

In the December 1966 APPROACH LT T. K. Woodka of VAW-12 suggested the use of grease blackening around the eyes to reduce glare while flying. Your answer pointed out the dangers of grease and oxygen mixtures.

I'd like to suggest the use of a charred cork for the same purpose. It can be very easily carried and used for darkening the skin for protection from the sun and glare during survival situations and as an aid to evasion in darkness. Many bow hunters use it to blotch the exposed skin to blend in with the brush. It has one more advantage: it is easily washed off.

SO1 P. J. DICKINSON
VA-44

▶ We see no reason why your method should not be used.

Very resp'y,

Headmouse

A Bit Much

Dear Headmouse:

A recent air combat survival incident in Vietnam points up an insidious survivor location problem. The pilot of a jet fighter bomber was shot down recently. After successfully parachuting out and reaching the ground, the pilot activated his survivor locator radio. I should say *radios*. He had three RT 10s, all going at once (two on "home" and one being used on voice mode). Fortunately a rescue helo was nearby and effected a rapid and uneventful recovery.

It is most interesting to note that each one of the survivor's three RT 10 radios was in turn blocking the other, thereby making transmission/reception impossible.

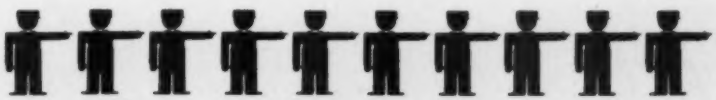
ANYMOUSE

▶ A word to the wise: in this case one's fine and three's a crowd!

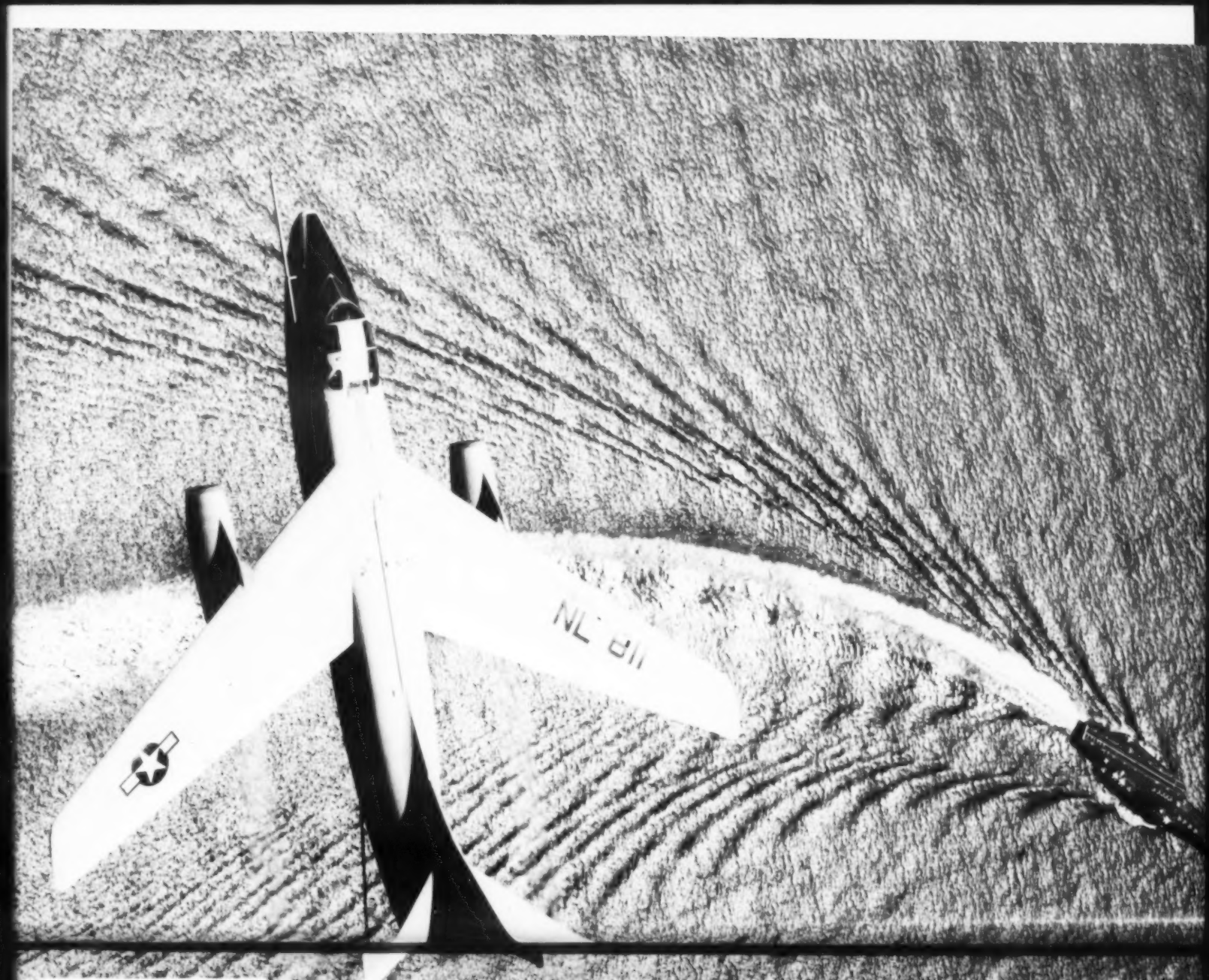
Very resp'y,

Headmouse

PASS IT ALONG!

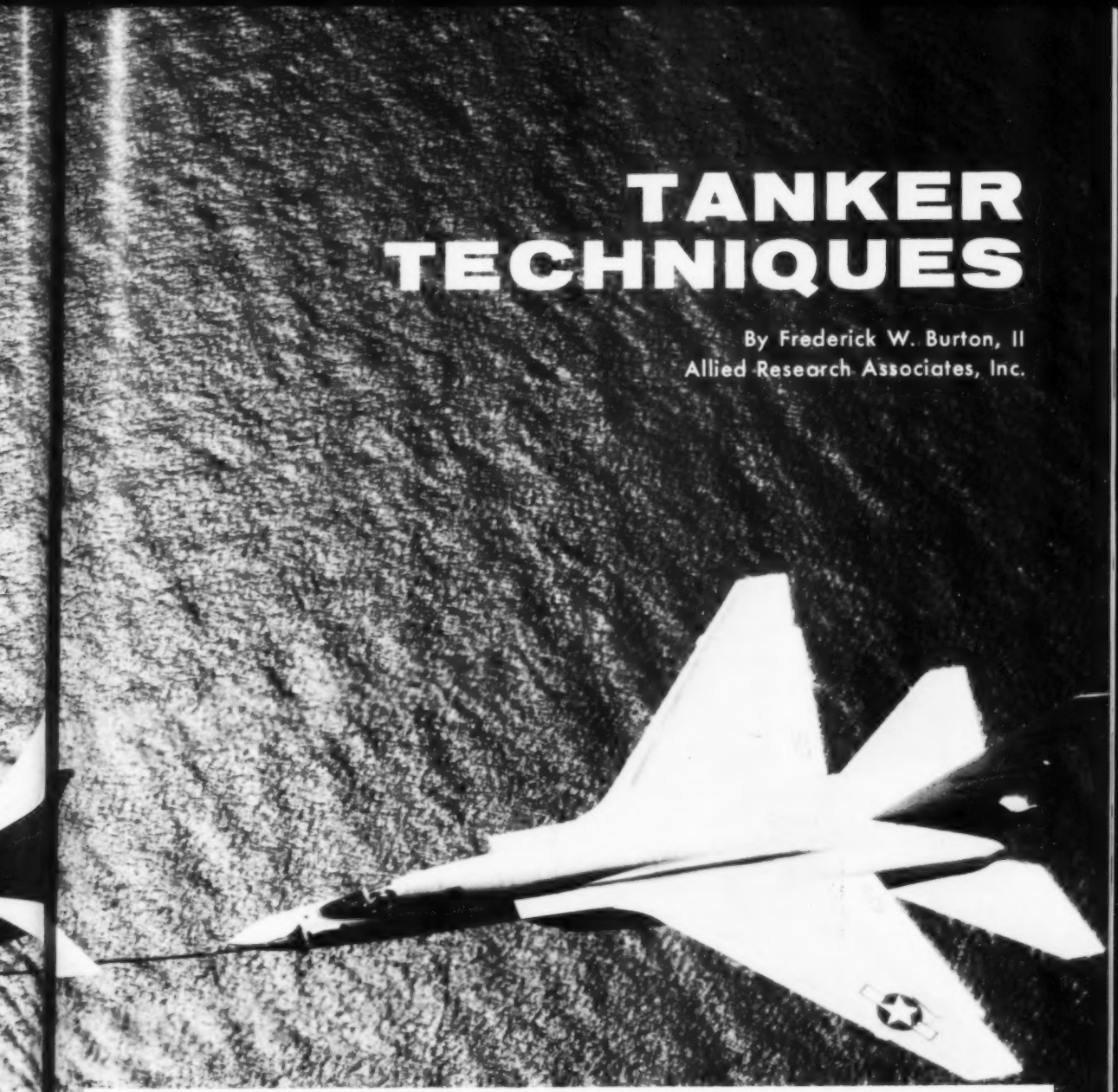


Each copy of APPROACH is meant for ten readers.



TANKER TECHNIQUES

By Frederick W. Burton, II
Allied Research Associates, Inc.



A-3 tankers were introduced to the fleet in 1959. For several years they were used primarily in fleet training exercises where failure of the tanker mission meant only a mission abort or an early recovery for the receiver aircraft.

Then with the beginning of the Southeast Asian conflict, the training period ended and the tanking mission took on major importance. A-3 tanker support of transoceanic flights became a common occurrence and scheduled tanker support of strike operations increased greatly. But the real worth of the A-3 tanker showed itself in the number of *unscheduled* air refuelings which began to take place. (By unscheduled, we refer to those refuelings in which the receiver is not specifically scheduled for tanking, but because of major battle damage or other circumstances, his only alternative becomes abandonment of the aircraft if refueling is unavailable.

Since the beginning of the Vietnam conflict tankers have been credited with over 200 aircraft saves. On one recent deployment, a 5-plane A-3 detachment was credited with 20 saves of this type. The dollar cost of the 20 aircraft saved totalled over 49 million dollars—an amount sufficient to operate and maintain those same five A-3 tankers for a period of 10 years. Keep in mind that this reckoning doesn't

Continued next page

even take into account the injuries or losses which the crews might have sustained if ejection had become necessary.

There are also numerous cases of battle damaged aircraft with serious fuel leaks being practically towed back to the birdfarm at the end of a tanker's hose. Some of these damaged birds have actually received more fuel than their tanks could originally hold in order to make the short trip back to the carrier. In one recent case, an A-4 hit in the fuel cell areas while on a strike mission hooked up to a tanker shortly after it was damaged. The badly-leaking *Skyhawk* consumed about 6 times the normal amount of fuel for the distance covered while the A-3 led it out to sea, rendezvoused with the carrier, then put it in position for making an approach.

Since every Navy pilot who flies an aircraft that has an air refueling capability stands a good chance of sooner or later gambling his aircraft against the odds of receiving a successful "drink," tanker techniques should be an important part of their training. Mr. Fred Burton of Allied Research Associates, Inc. has worked with A-3 tankers as a field service representative since the aircraft was first introduced to the fleet. In the following article he points out some experienced observations which should prove of value to both tanker and receiver crews.

CDR K. R. HAMILTON
HEAVY ATTACK ANALYST
NAVAVNSAFECEN

The A-3B tanker, using the probe and drogue refueling system was introduced to the naval aircraft inventory for fleet operations during September 1959. Prior to this time the heavy tanking missions were carried out by the AJ-1 and -2 aircraft. The A-3 tanker provided significant increases in mission-capability, some of which were:

1. Altitude/airspeed
2. Range/fuel available for transfer
3. Common internal and transferable fuel
4. Time/distance

Hose Reel Performance

The A-3 hose reel and the fuel delivery pump are powered from the aircraft utility hydraulic system. This source of power allows for a much cleaner, smaller and lighter system which is capable of working within the tanker operational envelope. Cockpit control of the hydraulic reel has reduced panel complexity to a minimum and eliminated myriads of switches, lights and automatic controls.

The system is straightforward and if the operation is clear in the mind of the user, many cross-checks are available. There is no system of interlocks to require a mandatory sequence of operations. The two key factors in performance are Knots Indicated Air Speed (KIAS) and internal fuel location and transfer within the tanker.

Let us first review the glossary of terms, pages 28 and 29. This is not an official standardized list. However, except for local doctrine, the author does not know of a Navywide accepted and approved list of terms. Also included is a suggested list of ground operation hand signals. The users must first establish that they are communicating about the refueling package to avoid confusion.

Figure 1 presents the basic forces encountered by the drogue, hose and receiver aircraft during operations and may serve better than words to explain their function.

Figure 2 explains the functional sequence of the hose reel in all modes of operation.

THE PROBE AND DROGUE SYSTEM—
(Force Diagram)

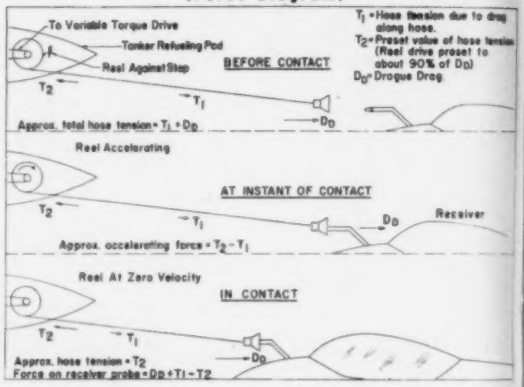

To Variable Torque Drive
Tanker Refueling Pod
Reel Against Stop
BEFORE CONTACT
T_1 = Hose tension due to drag along hose.
T_2 = Preset value of hose tension (Reel drive preset to about 90% of D_D)
D_D = Drogue Drag
Approx. total hose tension = $T_1 + D_D$
Reel Accelerating
AT INSTANT OF CONTACT
Receiver
Approx. accelerating force = $T_2 - T_1$
Reel At Zero Velocity
IN CONTACT
Approx. hose tension = T_2
Force on receiver probe = $D_D + T_1 - T_2$

Fig. 1

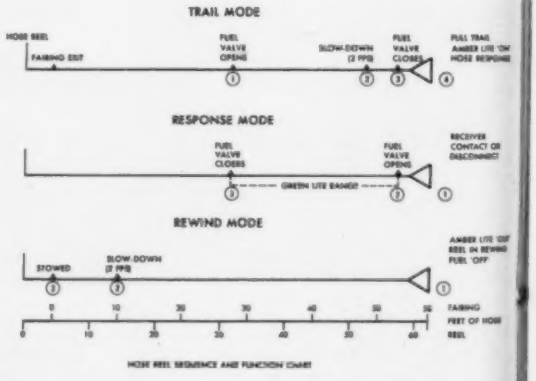
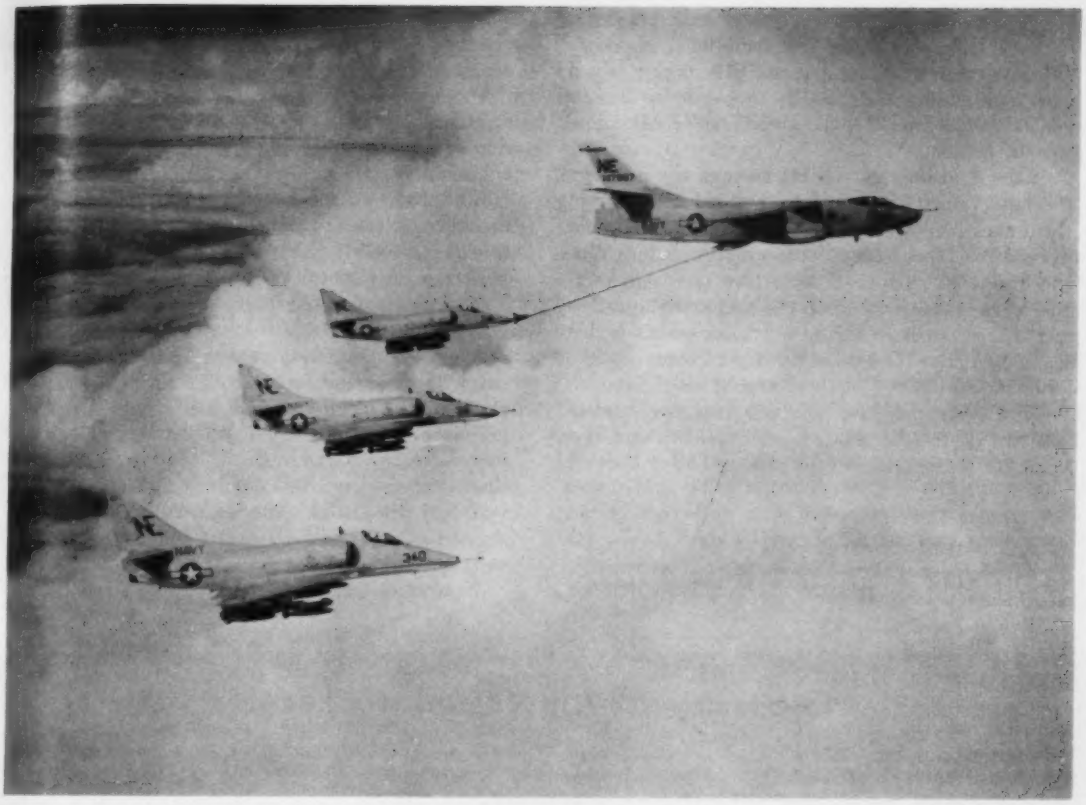


Fig. 2

It may be seen by Figure 1 that the reel drive system operates on a near balance between drogue drag *vs* reel torque. The drogue area is fixed; there-



Mutual understanding of air refueling terminology will aid operational and maintenance reliability.

fore, the drag is dependent upon KIAS. The amount of reel drive system torque is present to deliver a driving torque to the hose drum that will nearly balance the drogue drag. The A-3 torque values translated to airspeed are from 220 KIAS to 310 KIAS. Within these parameters the drive system control valve senses the drogue drag as hose drum torque and allows the drive motor to produce a near balancing hose tension. *This hose tension is then the primary factor controlling response action during receiver contact up to a closure rate of 10 fps.*

Obviously, if the closure rate exceeds the built-in limits of the system, if the present torque of the drive is not properly adjusted, if the drogue canopy area is altered or the reel system is not receiving the required hydraulic pressure and flow, the performance of the unit will be degraded. Once again, if the preset torque is correctly set once and all other constants remain unchanged, there is no need to tinker with this adjustment.

Normally, this preset torque is measured as hose tension during ground checks of the system. The hose is extended and a dynamometer placed in the line. Care should be taken to be certain that the hose is in a straight line and that it encounters minimum friction. It is most important that the hydraulic power supply produces pressures and flows equivalent to normal aircraft utility hydraulic system output.

Note: At no time should the hose be pulled out or attempts made to restrain it with manpower. The response and rewind loadings cover a range of 400 to 850 lbs hose tension and a free rewind rate above 10fps.

An inflight procedure may be used to verify and cross-check the drive torque setting. This verification check is commonly referred to as an "auto retract." The hose is trailed at the lower end of the speed envelope. The aircraft is slowed gradually until the hose and drogue start retracting in the response mode. This is the point of balance and shows where the preset torque is adjusted. The KIAS should be checked at this point. It is not necessary to allow

the hose to fully retract nor should it be allowed to do so at airspeeds below the operational envelope.* When auto retract commences, the tanker should start accelerating and the BN should move the reel control switch from TRAIL to OFF to TRAIL in one smooth motion.

If the drogue is not visible through the periscope, the auto retract point can be verified by observing the amber fuel light on the control panel. The tanker system must be set up for normal transfer. When the hose retracts 5 to 8′ or at the point where the fuel valve normally opens, the amber light will go out. The green light should not come on since there is no fuel flow. If the amber light comes back on prior to repositioning the reel control switch, you may be sure that the hose has retracted past the 27′ position. If this be the case, the tanker should continue to accelerate beyond 220 KIAS before the hose is trailed again. This KIAS is necessary to preclude backlash, crowding and loose hose on the drum.

The break-loose for the A-3 system should occur at 165 KIAS. This will indicate a response hose tension of approximately 400 lbs if measured during a ground check.

Now that we have a better understanding of how the drive operates in response we will further explore briefly the reel's full sequence as shown in Figure 2.

As the reel control switch is moved from OFF to TRAIL, a lockpin referred to as the pawl is withdrawn from the gearbox by a linear actuator. This is much like the action caused by moving the automatic transmission lever on your car out of park position. The reel drive is also energized hydraulically at this time to further tension the stowed hose and to remove any backlash in the gearbox so that withdrawal of the pawl will not be restricted. Upon full travel of the actuator the cockpit flip-flop indicator transfers from IN to OUT and the drive is released to trail the hose.

Remember, the flip-flop in the A-3 reflects pawl

*Except when making an "auto retract," the hose reel should never be allowed to operate outside its normal envelope which is 220 to 310 KIAS.

Glossary of Air Refueling Terms

1. The following is a list of terms and signals accepted as standard for Air Refueling during flight and ground operations.

2. The term Air Refueling shall replace the term Inflight Refueling as AR shall replace IFR. This is in accord with Specification Mil-A-19736-(Aer), Ref. APPROACH March 1960, Letter from Chief BuWeps.

Ejection—Movement of the drogue and coupling out of the storage tunnel when initiating the trail sequence.

Trail—Movement of the hose aft after initial ejection as it pays out to its fully extended length.

End of Trail—Farthest extent of normal trail and coinciding with response condition.

Response—Electrical actuation of a hydraulic circuit which applies a torque to the hose and drogue thru the drive system in an amount slightly less than the total hose, coupling and drogue drag. This creates a near balanced condition, so that when the receiver makes contact the reel will take up the slack hose. This condition is indicated by the AMBER fueling light illuminating.

Response Rate—The rate at which the reel will take up the slack hose as it is engaged and pushed in by the receiver. The A-3 rate is up to 10 ft/sec., 6.8 mph or 5.9 kph.

Closure Rate—The rate at which the receiver overtakes the tanker drogue and coupling. This should be in the range of 3 to 5 knots but in no case should it exceed the response rate of the particular reel.

Takeup—The "in" movement of the hose by the receiver to the fueling position. This fueling position is indicated by the AMBER light extinguishing and illumination of the GREEN fueling light. The A-3 distance is 5 to 8 feet from full trail position and can also be correlated with the white band markings on the hose.

Fueling Range—Any position inside the GREEN light range.

Back Out—Slowing of the receiver so it falls behind the tanker, taking the hose out with it to the end of trail position.

Breakaway—Completing a backout and further reducing power until the probe and coupling disconnect.

Inadvertent Breakaway—Disconnecting from the coupling prematurely or prior to the end of a normal backout.

Wet Break—Inadvertent breakaway while still within the GREEN light fueling range.

Breakaway Force—A preset load on the coupling toggles which requires a build up of force equal to this amount on the probe to effect a disconnect. The A-3 preset load is 440 pounds total and under dry conditions.

Wet Breakaway Force—Same as above but with an increase of 4 pounds of force for each pound of fuel pressure at the coupling.

Rewind—Retraction of the trailed hose to a stowed condition.

Amber Light—Signal light for receiver aircraft indicating the hose reel is in response condition. The tanker operator has a repeater light on his console. (Contact should not be made unless the AMBER light is illuminated.)

Green Light—Signal light for receiver aircraft indicating the hose reel is in the fueling range and in some installations indicates that fuel is flowing. The tanker operator has a repeater light on his console.

Auto Retract—A condition that occurs when the air drag on the drogue is slightly less than the response tension applied to the hose; therefore, the reel retracts or rewinds the hose automatically. Often this is used to establish the response settings. The hose is trailed and the reel goes into response at about 240 KIAS.* The aircraft is then slowed until the hose retracts automatically. This should occur at about 165 KIAS. *(A-3B only)

Contact—Called by the receiver when he successfully engages the coupling.

Clear—Called by the receiver when

lock position and not hose position.

As the hose is ejected from the fairing, aerodynamic forces take over and the resultant drogue drag pulls the hose out. Since the hydraulic drive is being rotated backwards by the effect of hose trail, the hydraulic motor becomes a pump and the control valve monitors and throttles the pump output to maintain a trail rate of 8 to 10 fps. As the drogue passes a point 27′ from its stowed position, a switch is tripped which opens the fuel valve and allows the hose to fill by gravity. This extra weight in the hose lowers the trail angle and helps to stabilize it. When the hose reaches a point about 10′ from full trail, a mechanical sensing device is activated which provides input to the control valve spool and further limits trail speed to 2 fps. At 5 to 8′ from full trail the fuel valve closes and the hose continues out to within 6 to 18″ of its total length. A second switch is tripped and the system enters response. Response is noted by illumination of the amber light.

Unless the fuel control switch is in either auto or manual position, the amber light will not come on.

The receiver makes contact engagement and pushes the hose in. As the 5 to 8′ mark from FULL TRAIL is passed, the limit switch opens which causes the fuel valve to open, energizes the fuel pump, and extinguishes the amber light. If fuel flow exceeds 20 gpm the green light will illuminate. The receiver is not free to position himself as he chooses, keeping in mind that he should not exceed the angular and conical limits of hose travel.

The fuel pump is hydraulically driven and the drive motor is controlled by a fuel pump pressure regulator valve. This valve senses fuel pressure drop across a venturi and positions itself accordingly, to control pump output. As the receiver fills and the flow decreases, the pressure drop across the venturi becomes less and the pump output drops. If the receiver moves in to the 27′ point from the stowed mark the fuel valve will close. The reason for valve actuation at this point is not because of receiver position but is the result of a service change incorporated for safety. Prior to this change the fuel valve would remain OPEN and the fuel pump on the line if the hose retracted into the tanker while in response due

he is clear of the drogue.

Hose Whip—Created by many factors; improper response torque, exceeding low temperature limits, excessive receiver closing rate, turbulence, unsteady tanker, damaged drogue canopy, fluctuating tanker utility hydraulic system, reel fuel delivery fuel pump cavitating due to low fuel supply.

Auto-Fuel—Delivering a predetermined amount of fuel to the receiver. The amount has been preset into a schedular type counter on the control panel.

Manual Fuel—Delivering fuel to the receiver, bypassing the tanker schedular, with the receiver controlling the quantity desired.

Surge—Created by the reel fuel delivery pump cavitating due to low fuel supply. This condition is most always accompanied by extremely weird noises, loud thumping and banging in the receiver as well as the tanker. In addition, the tanker may have odd sounds emitting from its hydraulic system. The hose is inclined to act erratically and the amber and green fueling lights will flash on and off alternately. The fuel pump pressure regulator valve attempts to control this condition; however, due to time lag the seriousness of the condition increases, much like pilot-induced oscillations. The above mentioned valve's function was not intended to correct this situation. *This surge can easily be prevented by stopping fuel transfer when the aux tank reaches the 1000 lbs remaining level and awaiting its replenishment.

*(A-3B only)

Ground Signals

Eject Drogue, Flip-Flop Indicator reads OUT.	Clenched fist, thumb extended horizontally, pointing aft. Butt of fist against open palm of other hand.
Retract Drogue, Flip-Flop Indicator reads IN.	Clenched fist, thumb extended horizontally, pointing forward. Thumb hitting open palm of other hand.
Trail Hose	First finger, either hand pointing up, indicating No. 1.
Rewind Hose.	First and Index finger, either hand pointing up, indicating No. 2.
Amber Light	Pointing to LEFT eye of director
Green Light	Pointing to RIGHT eye of director
Secure Power	Standard "Cut," open hand drawn across throat.
Hold Signal just passed until new signal is given	Clenched fist, either hand

to loss of drogue loading.

After taking on the desired amount of fuel, the receiver should reduce power gradually and back out taking the hose and drogue back to FULL TRAIL. The valving and light sequence is repeated and the hose is retracted. The mechanical sensing device comes into play about 10′ from the drogue stowed position slowing the rewind rate from 8 to 10 fps, to 2 fps. Upon stowing, the pawl locking system is activated and the cycle is complete.

Some details can be further amplified to possibly enhance the operation and maintenance of the A-3B tanker system.

Closing and Disengagement

The maximum hose take-up or response speed of the reel in the A-3 is 10 fps. Any engagement in excess of this speed will cause the hose to loop and whip. The desired closing speed is 3 to 5 KIAS above the tanker.

Technique varies for each type receiver, but one rule prevails; do not deviate, jab or make erratic changes during final line-up and engagement. (The same rules as making your final approach to the deck.) If the approach is poor and an emergency fuel state is not existing, back off and try again. When contact is made, do not worry about stopping forward motion, in fact, at the desired closing speed you may have to add power to overcome the drogue drag which you have now absorbed to match the tanker speed. Of course, power settings will vary for tanker/receiver during off-load/on-load of fuel.

While fueling, the receiver should attempt to hold the hose and drogue in its normal trailed position. This position may be varied to fit the immediate situation, but it should never exceed an angular cone of 30 degrees. This cone is established from an imaginary center line through the hose catenary curve when in the normal trail position. If the drogue is moved from the normal position, it should be returned to norm prior to commencing the disconnect procedure. This will prevent flailing about and possible damage to the receiver. The disconnect speed should not exceed the engagement differential. The reel drive system is so designed that attempts to pull the hose out in excess of 3 to 5 kts differential speed will cause the drive to sense an increase in hydraulic back pressure and in turn cause the hose to tension. The result is an inadvertent disconnect, possibly while the hose is in the fueling range. If this occurs, the tanker must recycle the reel so that the hose will fully extend and be set up for future contacts. If contact is attempted before the hose is re-extended, the hose and coupling will be pressurized, the fuel valve will be open, and the fuel pump will be on the line. This will result in very large engagement forces and a very high probability of spray and leakage.

Contact and Transfer

After the tanker has trailed the hose and set up his control panel, the receiver should note that the hose is fully extended. This may be observed by the white bands on the hose. The one-foot wide bands are spaced every 10′ from the drogue to the 40′ position. At 40′, the markings shift to narrow bands at one-foot intervals. These narrow bands continue for about 20′ on into the drogue stowage fairing. For a quick check at least 15 of the narrow bands should be visible when the hose is in position for contact, and the amber light should also be ON indicating that the reel is in response. If no amber light is visible the tanker should be checked for the following:

1. Reel Control—In TRAIL
2. Fuel Control—ON
3. Day/Nite Light SW—DAY
4. Cockpit Repeater Amber Light—On

If there is no confirmation of the amber light and contact must be made, extreme caution should be exercised since the reel may not be in the response mode of operation. Additionally, the green fuel flow light should be ON by the time the hose is pushed into the 40′ position. If the green fuel flow light does not illuminate and system operation was normal up to this point, the tanker should check for the following:

1. Has the receiver pushed the hose in the required amount?
2. Has the amber light been extinguished? If not, check the following:
   a. Does the U.B.B. fuel tank contain enough fuel to activate the system?
   b. Is the pilot's tanker transfer switch positioned to NORMAL?
3. If the amber light is out and there is still no transfer the receiver should recheck his system. If the situation permits, the probe actuating mechanism should be recycled. This is especially true if the system contains a shut-off valve controlled by AR probe extend limit switches.

Response

When response complaints arise, careful consideration should be given to reported receiver action. If the receiver was fast or moved the hose out of its normally trailed envelope where large friction forces are encountered in the stowage fairing, the squawk may not be justified. Further, if the response setting

is raised to overcome a problem of this type, the next receiver who is right-on-the-money may experience a situation where the drogue will "run in" as soon as he contacts it. Of course, the reverse is true if the squawk is high response.

Inadvertent Disconnect

The common cause of this is the receiver attempted to back out rapidly, therefore creating a speed differential greater than 3 to 5 kts. If the condition repeats itself with several receivers, the coupling release setting should be checked, the coupling toggles and rollers should be inspected, and if possible the receiver nozzle should be checked. *After* inadvertent disconnect, there is often the squawk that the hose did not re-extend by itself. The hose and drogue should not immediately trail since as we have noted earlier the system is almost balanced. The drogue will creep out if the system is left as is. However, this may take several minutes. BN action at this point should be to either rewind and trail, or move the reel control switch from TRAIL to OFF to TRAIL in one smooth operation. This will release the response circuit and allow the hose to go to FULL TRAIL.

Note: The reel control switch should never be *positioned* OFF and left OFF when the hose is extended from the fairing in flight. The reason for this is the drive motor is now functioning as a pump and the pump pressure will be related to drogue drag. If the KIAS envelope is exceeded, the developed hydraulic pressure may cause damage to the system.

Slow Rewind

When operating above 270 KIAS, rewinding the hose may prove to be a slow process. Uusally about one-half of the fully extended hose will retract normally, then the remainder seems to creep in. This is caused by the hose starting to wrap a second layer on the drum, and the result is loss of torque due to the larger effective drum diameter caused by the first layer of hose. The condition is caused by compromise in design trade-offs. The lowering of airspeed will eliminate the problem. Take note, however, that if the reel is stalled in this condition, it may not start rewinding when speed is reduced 10 kts or so. This is due to the force required to start the drum rotating. Of course this force is greater than that which is required to keep it in motion.

Mechanical Slow-Down Adjustment

The purpose of the slow-down is to reduce hose movement speed from 8 to 10 fps down to 2 fps near the end of trail and end of rewind. Mechanical linkage moves the spool in the control valve to restrict flow, by slowly closing the trail or rewind orifice. If

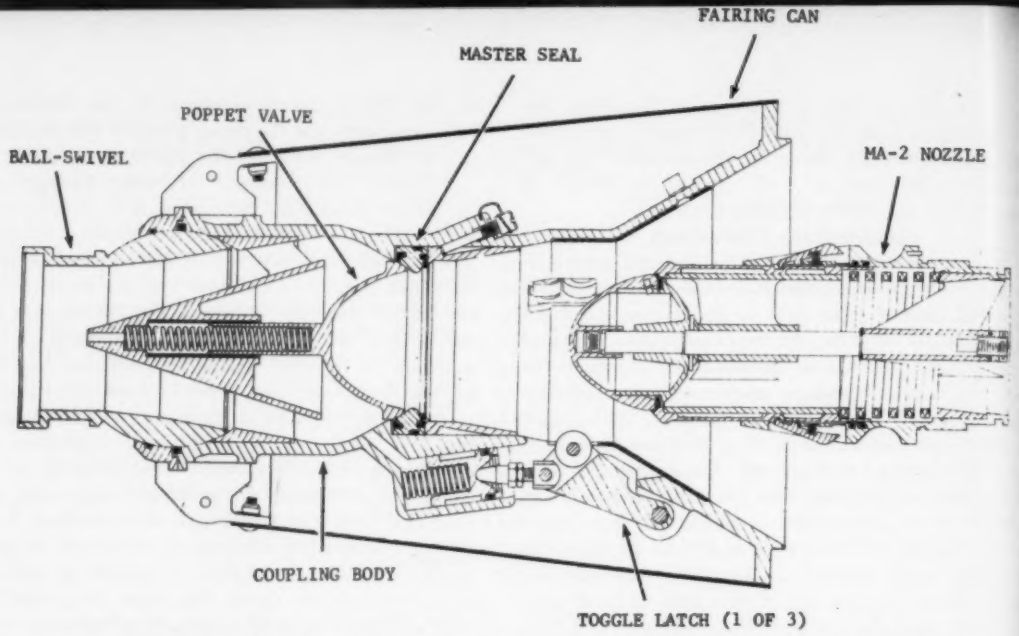


Fig. 3. Drogue troubles may not be in the tanker gear, but a result of tanker actions, techniques.

the linkage is adjusted to a point where slow-down takes effect at 12 to 14′ rather than 8 to 10′, the spool will close somewhere after the hose has traveled 10 to 12′. When this occurs, the drum can no longer rotate due to the hydraulic lock and of course the reel may never reach full trail and response or fully stowed or locked. Further, if this "long" adjustment is made, there is a distinct possibility of damaging the mechanical linkage and timing nut due to excessive overtravel of the linkage. When the proper adjustment is made, there are provisions for overtravel protection.

Reception Coupling and Nozzle

The coupling and nozzle are identified as the MA-2 type by Mil-Standards. This standard maintains compatibility between all services and each manufacturer's version of the part.

The function of the nozzle and coupling are shown in Figure 3.

The critical areas of the A-3 coupling are:

1. Coupling Poppet Valve Seal
2. Nozzle Sleeve Seal
3. Locking Toggle Rollers and Pre-Load Adjustment

The critical areas of the nozzle are:

4. Nose/Sleeve Seal
5. Sleeve Sealing Surface
6. Toggle Roller Ramp

The A-3 Coupling should be periodically checked for the condition of toggle rollers and seals. Preset breakaway force can be checked and adjusted using tool PJN 960048 listed in ASO catalog C-0006; Technical Publication NavAer 17-17-15BJ-1 provides instructions. NavWeps 03-100A-507 has been recently revised and provides more detailed data for maintaining the A-3 Reception Coupling.

Several MA-2 type probe nozzles are available and installed on receiver aircraft. Each has its respective NavWeps handbook and manufacturer's part number. A limited number of nozzles utilizing stainless steel components are now operating in the fleet on a Naval Air Systems Command Evaluation Program.

The coupling toggle roller ramp and locking groove of the nozzle should be inspected for scoring and marring periodically. Any gouging or plastic flow of base metal tends to affect disconnect forces and locking ability of the coupling toggles. The nozzle sleeve sealing surface should also be inspected. Roughness, scoring, peeling or corrosion of this surface can conceivably result in leakage during fuel transfer.

Areas of Improvement

Handbooks: The handbooks for the A12B-7 Hose Reel System are presently in the process of being prepared for reissue. The new revisions will be more comprehensive and detailed.

Drogue Generator Night Lighting System—The A-3 Tanker System is scheduled to receive the air-driven drogue generator night lighting system shortly. The GNLS is similar to the system recently installed on the A-4 buddy store and its operation is basically the same. This system replaces the radioactive button lights. Figure 4 shows the installation mounted on the reception coupling body and the lamp installation

on the drogue struts.

The system operates throughout the tanker envelope and is energized at any time the drogue is extended. The lighting system generator is driven by the ram airstream passing over blades of the "water wheel" propeller which projects outside the cover can. A built-in voltage regulator protects the system if the KIAS should exceed the upper limits of the operational envelope. Further, the voltage regulator protects the system if one or more light bulbs fail.

During installation of this kit, it is necessary to modify the cone which attaches the hose to the reception coupling according to the kit drawings. If this change is not made, the GNLS will fail to operate or will operate marginally, due to inefficient and ineffective air flow over the propeller.

Ground test of the system may be accomplished by blowing compressed air over the propeller and checking the lights. The air pressure should not exceed 90 psi from a ¼ inch maximum nozzle or tube which should be held not closer than 2" from the blades. Using this method, the generator RPM limits will not be exceeded.

Timing Nut Change—Under review at present is a design improvement to relocate the FULL TRAIL and fuel valve timing mechanism from the hub at the drum center to the gear box timing shaft.

Improved Reception Coupling—A universal coupling is now in the design study phase. This unit is configured to be interchangeable with any tanker installation. Further, it incorporates surge/pressure regulation within the coupling body to reduce the downstream surge hazard in the receiver. The force required to engage the nozzle has been reduced and permanent provisions for the night lighting system will be provided.

There are many funny stories about AR, but my favorite goes back to the AJ Tanker days, Circa 1955.

We were qualifying F-7U receivers and some of the younger pilots had never seen a hose and drogue trailed. At this time the AJ used a solid cone sheet metal drogue. If the bomb-bay door and hose trail procedure was not done in proper sequence, it was possible to have the bomb doors close on the drogue, crimping it into a figure eight. In this case, the trail operation was continued and, of course, the drogue was quite unstable. In fact, it was oscillating in 15' circles behind the tanker.

Fig. 4

About this time, the CO of the F-7U squadron and his wingman arrived aft of the tanker. Coming up on the radio, the young wingman's only comment was "Gosh darn, skipper, this thing is going to be harder to hit than I expected."

In closing, it is hoped that this review of the A-3 System will further operational and maintenance reliability.

Mr. Burton is employed by the Baltimore Division of Allied Research Associates, Inc., the company which acquired the entire assets and interests of Flight Refueling, Inc.

His background and association with aerial refueling embraces 15 years with probe and drogue systems, from research, development, test and evaluation to flight operations. The systems he has worked with include flying boat, transport, buddy and attack-type installations.

Mr. Burton joined the fleet as a tanker service representative in 1955 and transitioned to the A-3 tanker upon its delivery to the Naval Air Test Center Service Unit for trials in 1959.

Recently his company has funded various preliminary studies and feasibility hardware development programs for present and future generation tanker aircraft.

Helmet Save

AFTER an encounter with the tail rotor of a UH-34D, the wearer of the helmet shown in the accompanying photograph got up and walked away.

On landing approach, the port window of the helicopter had fallen out. In response to the pilot's request for someone to retrieve the window, the gunner ran aft. As he did so, he stepped in a puddle of water, lost his balance and fell into the tail rotor arc. The rotor struck his hard hat six times, penetrating to 1½" depth. The gunner—his only injuries a few minor cuts of the scalp—picked up the window and finished his job.

Notes from

Loosely Strapped

WHEN the student heard the instructor pilot at the controls command "Eject!" as the TF-9J spun inverted at 10,000', his seat was full up and he was "hanging in his straps." Fearing he could not pull the face curtain without worsening his already poor body position, he reached for the secondary firing handle. "Because he routinely flew with the safety guard in the SAFE position," the reports states, "he found it SAFE." He could only reach the guard with his fingertips and was unable to exert enough force to move it aside. He had to eject using the face curtain.

On parachute opening, he felt back pain. He could not get into an erect landing position during descent and his back pain became severe as he landed in a sitting position.

Ejection forces in an unusual attitude and poor body position at ejection were tagged as the most probable cause of the student's back injury. His poor body position was due largely to the fact that he was not strapped in tightly enough in the first place.

Decompression

WHILE an EA-3B was climbing through FL 250, the plexiglass panel in the cockpit enclosure on the navigator's starboard side failed structurally and was blown outward by normal cabin pressurization. The pilot immediately opened the speedbrakes, reduced engine power and descended to 4000'.

The navigator's helmet was buffeted initially, causing him to lose one ear pad. The chinstrap bruised and scratched his jaw, but the helmet stayed on. He was fully strapped into his seat when the decompression occurred and sustained no injury.

Quotable Quote

SINCE we cannot basically change man, our goal is to optimize man's responses, define his limitations and, if possible, design to these criteria or, if impossible, provide him with the mechanical or electrical aids necessary to accomplish his mission in safety.

—Charles I. Barron, M.D.

To Get The Hang Of It

AFTER ejection and parachute descent into the water at night, a pilot was unable to locate his flares, strobe light or whistle after he had inflated one side of his Mk-3C life preserver.

"I kept looking for these devices right up to the time the whaleboat came alongside," he said later. He was unable to find the second life preserver inflation toggle in the dark.

During the investigation, the pilot, the squadron survival officer and the squadron flight surgeon took the pilot's torso harness and life preserver to the station's swimming pool to check accessibility of the gear. The gear was accessible; lack of familiarity with its location was the problem. As a result of this finding, the squadron's survival training program has been modified as follows:

- When the replacement pilots are initially fitted with their torso harnesses, they are lifted off the ground to check the fitting. In the future, they will be required to go through the entire post ejection sequence blindfolded. This includes pulling and discarding the D-ring, disconnecting the oxygen hose and discarding the oxygen mask. The pilot will be fitted with an inflated Mk-3C life preserver and will be required to locate the strobe light, shroud cutter, sheath knife and day/night signal flares.
- A second lecture on survival gear and water survival has been inserted into the syllabus. This lecture will be given just prior to commencing carrier qualifications. At this time, each pilot will be required to complete a second torso harness "hang" as described above.
- The squadron has requested the naval air station to revise its water survival training course so that the torso harness provided at the station's pool be equipped with a Mk-3C life preserver, day/night signal flares, strobe light, sheath knife and shroud cutter. While in the water, the pilot would be required to actuate the Mk-3C, locate and remove the shroud cutter knife, locate and remove the sheath knife, locate and actuate the strobe light, and correctly identify the night end of the day/night signal flare.

Conditioning

A LARGE measure of credit for the success of this ditching must go to the safety officer. His repeated ditching drills and constant chanting of "unplug . . . unstrap . . . and go" helped to make the entire operation run like a routine ditching drill rather than an actual emergency.

—Helo copilot

your Flight Surgeon

Training Rig

IT is noted that one crewmember had difficulty releasing his Koch fittings (in the water after a successful ejection) apparently due to unfamiliarity. It is a very simple matter to provide pendant straps and fittings in the ready room or other space in order to give air crews sufficient practice with this equipment.

—2nd endorsement, AAR

Crash Crew Training

WHEN station crash crew personnel at the scene of an RA-5C accident were unfamiliar with the Koch harness fittings, the injured pilot, himself, had to assist them. The board recommended that the station "investigate crash crew indoctrination and training to insure they are thoroughly familiar with the rescue procedures pertaining to the aircraft that are based at the station and in particular, the RA-5C." An endorser recommended that, in addition to indoctrination and training using Naval Air Mobile Training Group (NAMTG) facilities, periodic drills similar to those conducted aboard carriers be conducted on returning aircraft.

Waffle Weave

ON a flight which terminated in ejection over land, neither the pilot nor instructor pilot wore an anti-exposure suit since temperatures were within NATOPS limits. Although both men were exposed to approximately the same environmental conditions before rescue, it was evident, the investigating flight surgeon reported, that the pilot who had on waffle weave underwear fared better than the instructor who did not. The flight surgeon recommends the use of waffle weave underwear on winter flights when the anti-exposure suit is not used.

Anti-Exposure Suit Liners

SOME pilots and crewmen are wearing waffle weave underwear under their anti-exposure suits. Only regulation liners are authorized for wear with anti-exposure suits. Any other inner garments compromise the effectiveness of anti-exposure equipment.

1. Scrapped T-2 tire—cut to form wheels chock.

Meridian Chock

MAN'S ingenuity in getting all the good out of tires seems to be endless. Perhaps no other item has been put to more uses other than that for which it was designed.

Here's how NAAS Meridian filled its chock needs:

By simply making three cuts in a scrapped T-2 tire (Photo 1), the safety aspects were satisfied:

- Nonsplintering
- Nonsparking
- Good holding qualities

The operational aspect of using the chock is good. The technique of opening the chock is easy to master, and the positioning of the chock around the wheels is accomplished as quickly as other types of chocks (photo 2).

The economical aspect is outstanding—the cost of scrapped tires is zero. The only cost involved is the replacement of hack saw blades used in cutting through the tire beads.

—Contributed by CDR R. M. DeBaets *(See Letters page 46)*

The rubber chock appears to be quite effective, for smaller aircraft, on clean, dry surfaces. On surfaces where oil, snow or ice may be present, its effectiveness may be reduced much more than in the case of wood chocks.—Ed.

2. Plane captain positions chock around T-2 wheel.

k

heel.

Westward Ho!

By LCDR J. W. Lucchesi

It was a typical southwestern day. Hot and dusty as far as the eye could see. The engine ran smoothly, emitting a throaty roar as only a 3350 can. These could have been called some of those "hours of boredom," except for the panorama of the countryside below. Mountains, valleys, slim silver rivers twisting between green fields and dusty desert. "Navy 35281, Navy Litchfield tower, over!" The transmission brought me quickly back to reality. "Navy Litch tower, Navy 35281, go ahead, over." "Roger 281, our DF gear isn't picking you up at your present altitude, can you go to Angels 15 and give us a short count? We'll see if we can't work you there, over."

"Roger Litch tower, 281 climbing, I'll give you a call when level at 15, out." I added climb power, checked the mixture, oil pressure, cylinder head temperature and started making gentle turns to clear the area as I climbed. Oh, oh, 12,000; about time to go into high blower or it will take all day to get to 15. Throttle back, prop back, check mixture RICH, shift into HIGH. Good. Now back to climb power, better close those cowls a little too, the engine's running a little cool. I was thinking "I hope this thing checks out on deck. It's running too well to have anything wrong with it."

I'd left the Naval Air Station at Quonset Point two days before. I was to ferry this *Able Dog* to Alameda, where it was going to be put in preservation for the long trip to Viet Nam.

"Where in hell did that sump light come from?" Big and red and stimulating. Let's see . . . oil pressure, ok, cylinder head temp, ok, oil temp, ok. Well it hasn't started running rough so I'll just leave everything alone and go into Litch just over the hill.

The approach and landing at Litch were uneventful and when I parked the aircraft I felt very relieved. I wondered what we would find in the sump.

It turned out to be a little chunk of steel. We

cleaned the sumps and ran the engine for nearly an hour on the deck. Nothing. Everybody figured it was just a piece broken loose from normal wear. Since it was only one piece, it was not too significant. Everyone agreed that there was no problem and I could go if I wanted to. Everyone but the Ops officer. According to the engine bulletin it required a one hour test flight prior to giving the engine an "up." Well, I tried to talk him out of it, figuring one hour on the deck was just as good as one hour in the air, but no soap. "Fly a test hop or you don't go." So I flew a test hop.

While I was filing, the duty officer asked if I could help out the tower personnel by giving them an assist calibrating their DF gear. I figured I might as well do something while I was up there, other than bore holes in the sky.

Forty minutes passed and everything seemed to be working fine. The DF equipment seemed right on the button, so I called and told them I was coming in to land. I descended into the pattern and made an uneventful landing, except that when I turned to taxi in I was greeted by two fire trucks and told to shut down immediately.

"Litch tower, 281, understand you want me to shut down, is that affirm?"

"Roger 281 your aircraft is covered with oil. Shut down and get out."

I did, and when I saw my bird I couldn't believe it. From the wings back it was covered with oil. Everything! It was dripping on the ground as though it had just been dipped.

I checked the oil tank and there were only four gallons left. I had started with 32. I hadn't used four gallons all the way across. Now 28 gallons in an hour and a half!

Inspection of the engine compartment didn't show any leaks. All of the lines were tight. Then where did the oil go? The cap and dipstick were tight, the oil tank was secure.

We cleaned the airplane and then noticed that the oil was still dripping from a small drain in the center of the fuselage between the wings. An examination showed no oil inside the aircraft. Where was it coming from? To this day I don't know why, but I looked in the water tank. This tank is normally empty and is filled with water only when max performance is required from the engine. A switch in the cockpit that pumps the water to the carburetor to augment the entire system had been deactivated. However, the tank was full of engine oil. Since it only held about 15 gallons we guessed the rest of the oil had been pumped into the tank and then out the overboard drain line. Sure enough, but how?

Correct Installation of Water Injection Adapter Parts and MAP Regulator R3350-26W, -26WA, 30W, -30WA

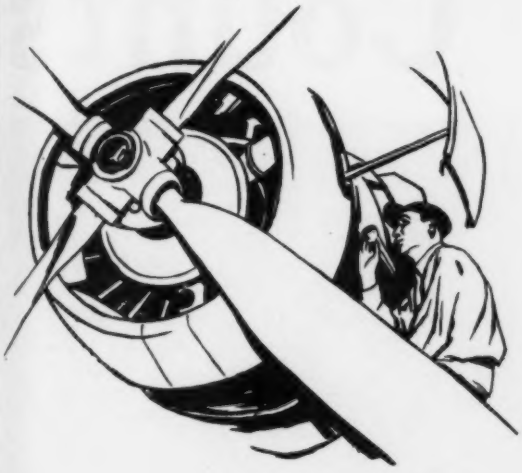
In order to operate satisfactorily, it is essential that all detail parts of the MAP Regulator and Water Injection Power Control units be correctly installed. This is especially important as regards the gaskets involved.

Water Injection Metering Valve Bellows Body Adapter Spacer, PN 139491, Gasket PN 131166 and Power Control Unit Spacer Gasket PN 130324. Incorrect installation will result in HIGH clutch oil being forced into the water supply tank. See Fig. 1.

MAP Regulator to Adapter Housing Gasket PN 130322. Incorrect installation of gasket will permit engine oil enroute to the MAP regulator to seep into the MAP and supercharger inlet suction passage. This condition will result in improper operation of the MAP regulator and cause the engine induction system to load up oil so as to emit smoke from the exhaust ports. See Fig. 2.

The two systems are not connected.

We pondered this for hours. How could an airplane use 4 gallons of oil in about 10 hours and then suddenly lose 28 gallons in an hour and a half. It seemed impossible.



Just then a mechanic approached and asked "What's the problem?" He was very experienced with *Skyraiders* and heard we had some difficulty. He thought he might help. I recognized him as one of the maintenance crew from the other end of the field. He had just stopped by on his way to chow to see what was going on. I told him what happened and he asked if I had been in high blower. I told him I had, and then he asked me if I had been in high blower at any other time. I said "No, just on the test flight." He nodded and said he thought he knew the problem. He grabbed a wrench, took off a fitting below the carb, and he was right! *A gasket had been installed upside down.* The water injection system is normally sealed off at this point. By installing the gasket improperly, engine oil normally blocked by the fitting is sucked from the engine any time the engine is operated in high blower. It had happened once in his old squadron and he hadn't forgotten. If I had stayed airborne for another 15 minutes the engine would have seized and we might never have found the cause.

It was a typical southwestern day, hot and dusty as far as the eye could see. As I climbed out towards Alameda I couldn't help but wonder, "What would have happened if that mechanic hadn't wandered by?"

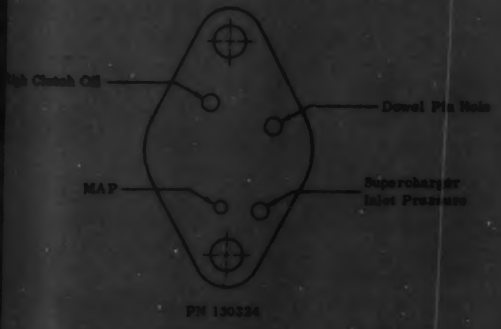


Fig. 1

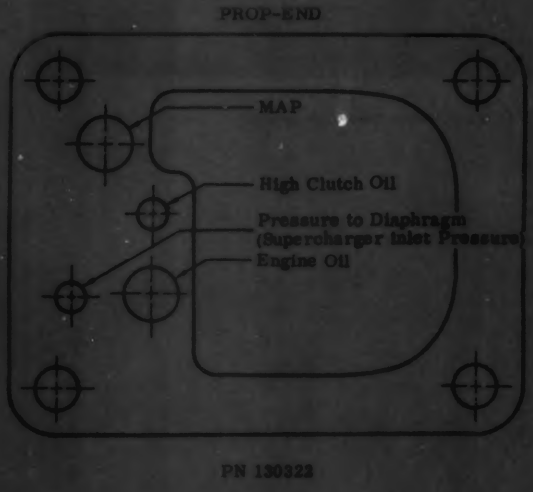


Fig. 2

Neatness Counts

"Chief, step into my office, if you will . . .

Chief, I sure want to talk to you about something that's been bothering me.

Step into my office if you will, right into the cockpit, and we'll chat a minute. Sure don't get a chance like this very often. Sit down there behind the controls. Be my guest. As a matter of fact, be *me* for a few minutes.

You're in my home now. At least for a few precious hours each month this is my home. This is where I live and move, completely dependent upon this "house" just as you would be.

My problem is that other people visit this house when I'm not around. That part is okay—they are supposed to. A lot of work has to be done in this house that a pilot can't do, and I just can't be here to make sure that these visitors wipe their feet or do their jobs neatly. I have to rely upon these "guests" with a great, implicit faith, as all pilots must. And everything in here must work as advertised, because this house moves—and the outside world is mighty cold and inhospitable, believe me.

Now while you're here being the pilot, run through part of a flight with me. Remember, you're driving. You've completed the takeoff, have your gear and flaps up, and you're trimmed. Maybe in a fighter you'd be in spread formation at this point. You'd have time to look around, re-check the bird, and what have you.

Now, then. Gazing idly around the cockpit you notice (right by your foot, there—see it?) a small machine screw. Remember, now, you're an airplane driver, not a maintenance type. So, now you have an interesting puzzle to play with as you tool along. Did this screw just work its way out of some vital connection? Are you, very soon, going to lose some hunk of electrical or mechanical gear? Or, is this a spare, an extra—maybe the part that rolled out of sight the last time someone was "maintaining" in the cockpit? Remember what I said about the house?

Stray objects can play havoc with an already busy pilot's mind. . . . To control cockpit cleanliness, we must control what goes into it.

The sudden, unpredictable appearance of spare bird-parts gives the pilot some cause for concern. It sure dilutes the faith that we were talking about earlier.

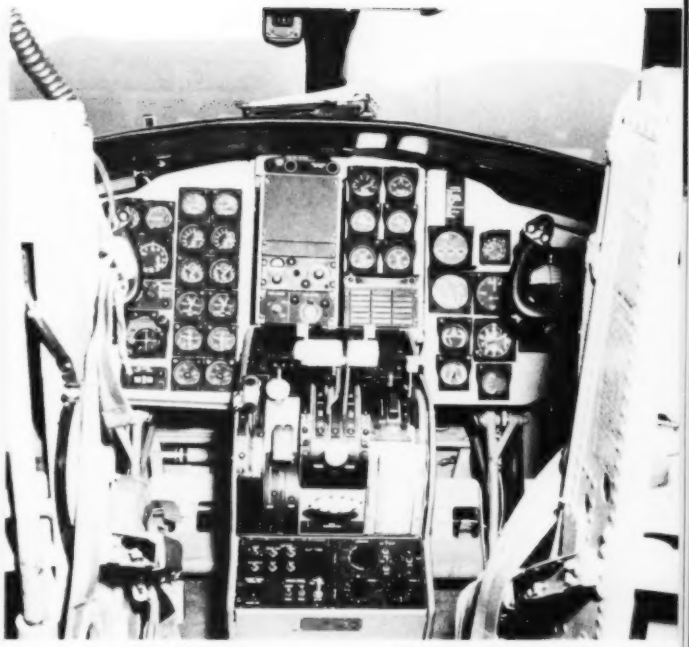
Here's another side of the story for the smaller aircraft. Every now and then in the fighter business it becomes necessary to fly upside down, or to pull negative G. The aircraft designers are aware of this, and have cleverly constructed the machines so that these brief periods do not interfere with normal operation. However, nowadays, these negative G are avoided. One reason is that as soon as negative G is applied, there is an absolutely amazing shower of nuts, bolts, bits of lock-wire, dust, dirt, and what have you that will drop on the pilot's head when he rolls erect. This is the stuff that can be seen: how much more is there that can't be seen?

This worn old tiger used to roll the bird upside down and shake it, then spend a few seconds tidying up the bits of pencils, clamps, and miscellaneous junk so that the bird would be neat for the next pilot. Not any more. The last time around, when I rolled right-side-to, the aircraft would no longer turn left. Then there was an interesting period when the tower insisted on left-hand traffic, and I was trying to explain the condition in the cockpit that made right-hand traffic far more desirable. Everything returned to normal when I finally got onto the ground. The foreign object that must have jammed the flight controls apparently jarred loose while taxiing.

The days when we could put a hose in the cockpit and wash the debris out the tailwheel well are long since gone. The only way to clean up a cockpit now, and insure a clean house, is to control what goes in and clean out the unwanted stuff by hand.

I'll make a deal with you, Chief. You work on your boys and I'll work on the pilots. Between us we ought to be able to tidy up a bit. In this business, *neatness counts.*

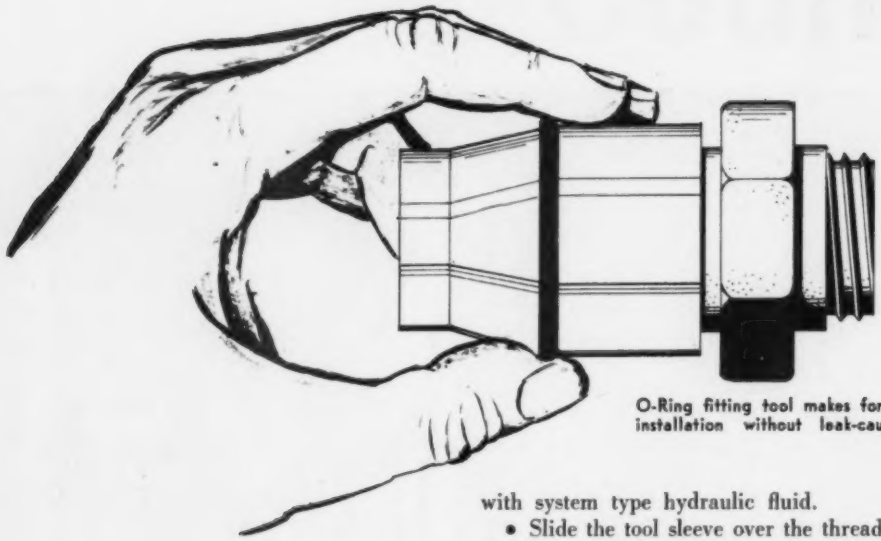
—Courtesy USAF "Maintenance Review"



. . . between us we can tidy up a bit."

NOTES

and comments on maintenance



O-Ring fitting tool makes for faster, easier installation without leak-causing damage.

O-Ring Installation Tool

ONE of the common causes of leaks in an aircraft hydraulic system fitting is damage to the seals during installation. Sliding the O-ring seal into position over threads or sharp grooves can cause a cut across the cross-sectional periphery of the seal—or merely rubbing across sharp threads can damage a seal to the leaking point.

An O-Ring Fitting Tool (ORFit) Kit FSN 5120-937-7428 containing 13 sizes ranging from 1/8" through 2" is available. The fitting tools in this kit are invaluable for the proper installation of O-rings on universal bolt fittings and unions, bulkhead fittings and unions, nonpositioning type fittings, flare tube unions and banjo fittings. It is a very simple tool that solves a big problem.

Here's how easy it is to use the tool:

- Select the tool size corresponding to the tube O.D.
- Be sure the installation area is free of dirt and chips.
- Lubricate the O-ring and the outside of the tool with system type hydraulic fluid.
- Slide the tool sleeve over the threads, then feed the O-ring off the tool into position.

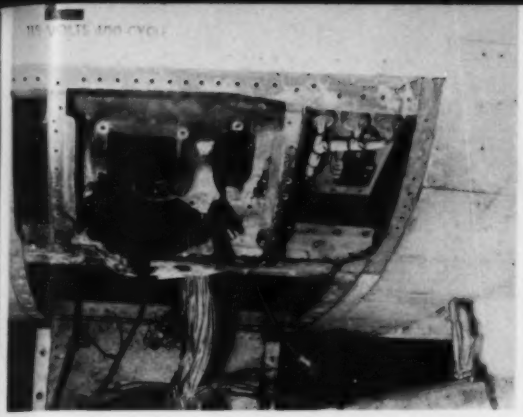
The cost of the kit is very nominal, perhaps costing less than the machining of a single bullet in your own machine shop.

Closing the Circuit

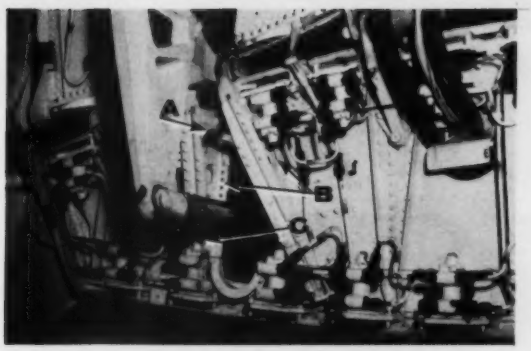
AN F-8E was spotted on the port catapult as a ready combat air patrol aircraft. At the end of the day, the *Crusader* had not flown. Heavy weather area was being transited so the wings were folded, the numbers of tie-downs were increased and the external electrical power cable was unplugged.

A short time later, a person or persons unknown noticed that the external electrical power cable was unplugged and for reasons of their own, re-inserted it into the external power receptacle of the aircraft. This was not an immediate problem because the deck edge power was not energized. Unfortunately a little later the deck edge power was needed elsewhere, so the system was energized. A short caused an electrical fire in the secured aircraft.

After the fire was brought under control, investi-



A wet power receptacle resulted in a short and fire when the ship's circuit was energized.



Wind damage—Point A: Lock-lock strap broken; B: cracked A-frame (note popped rivets); C: markings indicate A-frame contacted wing lock assy.

gation revealed that salt water in the electric plug caused the short. As a result of the fire, damage consisted of: fuselage skin panel encompassing the external power receptacle and support brackets was burned beyond repair; the intake duct skin directly above the receptacle was buckled by excessive heat; also charred beyond repair were wire insulations, relays and related electrical components.

The chain of events:

—Plane captain unplugs power cable (did he first turn off the power at the station?)

—Plane captain completes heavy weather security of his aircraft (did he complete his job in that the power cable was left on deck?)

—Deck edge power secured.

—Someone (probably responsible for security of flight deck) sees cable lying near the aircraft—has two choices (1) stow cable (2) plug into aircraft. Chooses second alternative.

—Deck edge power energized.

—Fire! Fire! on the flight deck.

Omission of duties due to haste or oversight leads to corrective action by others. Acts of helpfulness can close the circuit of events. In this instance, the cable could have been properly stowed by either the plane captain or the unknown persons.

Wingfold Wind Damage

A *Stoof* was returning to the line in a 20-kt wind with the wings folded and the gust lock set. The co-pilot was having considerable difficulty steering the aircraft while moving in the strong crosswind so the pilot tried to assist. A few minutes later, the crew gave up, shut down the engines and called for a tow tractor. While waiting for assistance, the pilot noted unusual movements of the folded starboard wing. An outside observer noted that the wing flapped up as high as the vertical position. The decision was quickly made to restart the engines to utilize the hydraulic wingfold cylinders in steadying the wings while installing the jury struts.

With ground crew assistance, the airplane was finally secured. Subsequent investigation revealed considerable damage to both wings in the folding area.

Whenever moving or taxiing in high surface winds, wing spreading and folding of S-2 model aircraft should be done with extreme care and caution.

Effect of flight line jet blast

CO_2 extinguisher discharge horn melted; charge released through safety disc. Pin and seal were in place.

Shell Game

Home-made compressor cleaner and its designer ADJ2 J. [illegible] Jacobsen, VAW-11 aboard ENTERPRISE.

The power plant maintenance crew of VAW-11 Detachment Mike deployed aboard ENTERPRISE off the coast of North Vietnam was faced with the problem of inefficiency in two of their T56 turboprop engines in E-2A *Hawkeyes*.

NavWeps 02B-5DB-2, 2-133, calls for the use of a compressor cleaning tool (Walnut Shell Injection Cleaning Fixture 6795916) which feeds finely ground walnut shells through the engine, removing oil, dirt and other deposits on the compressor units. Since the machine was not available the power plant crew built one using a reusable container, a funnel, a strip of angle metal and a copper tube. See photo, top, right.

Now the big question: would it work? As the machine began feeding the ground walnut shells into the first engine the mechs watched closely the rate at which the walnut shells were being fed into the compressor. Engine compressor tests following the experiment proved successful, accomplishing the same results as the store-bought $2200 machine used back in the States. See photo, right.

Experience by airlines has shown that compressor cleaning by this method results in satisfactory power restoration, lower operating temperatures, reduced fuel consumption and greater torque pressures. But the big savings comes from the fact that the engine does not have to be pulled from the aircraft and sent through the maintenance shop for disassembly and cleaning.

One airline is now conducting tests to determine whether or not an engine can be maintained at optimum performance, fuel consumption and torque pressures by using walnut treatment as a preventive measure. So far, the results indicate about 10 pounds of ground hulls per minute should be injected every 1000 hours.

Store-bought walnut shell injection fixture 6795916, To[illegible] Group 3, for the *Hawkeye*.

While NavWeps 02B-5DB-2 does not specify any cleaning interval, it does note that compressor clean[illegible]ing by this method requires four gallons of screened ground shells fed through two 3/16" openings o[illegible] the hopper valves into the engine while it is operating at Flight Idle.

With the development of more experience with this new shell game, T56 engines can be expected to achieve a longer life.

MURPHY'S LAW *

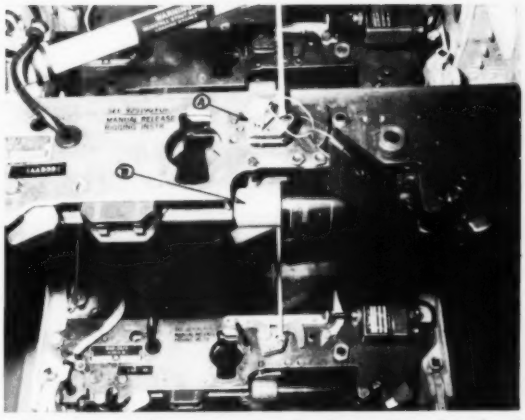
AFTER installation of a MAU-38 rack in a P-3 bomb bay the manual release mechanism was adjusted utilizing the proper rig pin location. A live Mk-54 depth charge was then loaded and the rack safety pin removed. Although the pin removed without binding, the Mk-54 dropped five feet to the ramp. Fortunately there was no detonation or other injury. The appearance of the manual release and rig pin installations (A) in both photographs at right is identical, however the release, top photo, is unsafe. The key to the error is the position of the Aero 7B release (B), which is uncocked in the top photo.

Failure to cock the Aero 7B release prior to adjusting the manual release mechanism allowed the internal trigger to be improperly positioned by about 50 percent of its full 1/4" travel. Thus when the Aero 7B release was subsequently cocked the rack remained in a partially released position. After the Mk-54 was loaded, the slight jarring associated with the aircraft taxiing enabled the trigger to release. Removal of the safety pin allowed the rack to release.

Manual release adjustment procedures are displayed by decals on the forward bulkhead of the bomb bay, however they neither state nor caution that the Aero 7B release must be cocked prior to making the adjustment. Once improperly rigged, visual detection of the oversight is difficult and cannot be completely verified unless the release is cocked and the rig pin again inserted to check the installation.

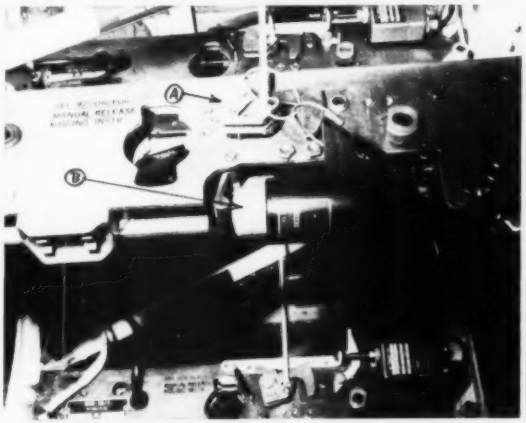
The squadron has recommended the inclusion of a decal adjacent to those presently installed to warn personnel to cock the Aero 7B release prior to adjusting the manual release.

—VP-44



Above: Incorrectly rigged manual release. Note length of item B in uncocked position.

Below: Properly rigged manual release. Note length of item B in cocked position.



If an aircraft part can be installed incorrectly, someone will install it that way!

Letters

APPROACH welcomes letters from its readers. All letters should be signed though names will be withheld on request.

Address: APPROACH Editor, U. S. Naval Aviation Safety Center, NAS Norfolk, Va. 23511. Views expressed are those of the writers and do not imply endorsement by the U. S. Naval Aviation Safety Center.

"In Extremis"

FPO, San Francisco—Your article "In Extremis . . ." in the March 1967 APPROACH not only generated much belated securing of survival gear among squadron pilots but also generated some thought as to, "What would I do if I'm hit and start passing out?" The idea of locating ammonia inhalent ampules (FSN 6505-106-0875) within easy reach in each cockpit appeared to be the best answer.

After experimentation with ordnance tape and glue and various locations in the cockpit, a small bandoleer (Photo 2) was decided upon. Photo 1 shows it snapped around the stick. In this position the capsules may be easily reached with either hand and are not easily broken by daily activity in the cockpit.

LCDR L. F. CARSON, JR.
ASO, VA-94

• A local flight surgeon recalls that he did this for his pilots in Korea, his method being to stick two capsules on the windscreen with cellophane tape. (The capsules were used in four instances.) However, as far as we know there is no official authorization for such procedures.

1 Bandoleer in place on stick.

2 Ammonia ampules in bandoleer.

Chock Talk

NAS Meridian—The April issue has a very good article on the use of aircraft wheel chocks. The comment concerning chocks for shore stations as made "per attached sample" has encouraged me to submit Navy Meridian's chock, in case other stations are looking for a sample to follow. . . .

A local Beneficial Suggestion has been awarded for this chock.

CDR R. M. DEBAETS
ACFT MAINT OFFICER

• See page 36 for photo and details.

First Hand Experience

FPO, San Francisco—Re "View Lighter Hazard," p. 41 of the April issue: While carrying a lighter such as was described in that article, I boarded an eastbound aircraft out of a California NAS. As the aircraft

reached cruising altitude I felt a cold, damp sensation on my leg.

A hasty investigation showed the view lighter had ruptured due to pressure differential and a deep scratch in the plastic lighter case. The fluid, of course, boiled away quite rapidly at low pressure, causing a frost-bitten spot about two inches in diameter.

This hazard, in addition to the fire hazard mentioned in your article makes these lighters a chancy proposition at best for the airman.

BRIAN W. MOORE
V-2 DIVISION
USS ORISKANY

• Thanks for the testimonial. Smokers please note.

Rice Hauling Tip

Vietnam—The May issue pointed out the rice problem ("Rice Strength," p. 17) in the CH-46A. Using the CH-47A *Chinook* here in the III and IV Corps Areas and hauling rice on a continual basis, we have made it SOP that each aircraft carry a broom and that the ramp hinge area be swept prior to raising or lowering the ramp.

This 10-second job has saved us the problem your CH-46A aviators have had up north. The hinge system is the same on both aircraft.

Your article on RT-10A survival radios is required reading for all of our aviators.

MAJ S. C. BERDUX JR. U. S. ARMY
147TH ASSAULT SUPPORT HELO CO.

• Thank you, Major, on behalf of our rice-carrying mates. It is hoped that clean sweep-downs become a practice with them as a result of your tip.

Oil Analysis Save

NAPTC Trenton, N. J.—This letter is written in appreciation of the fine job APPROACH has been doing in putting out the word on some of the Navy's excellent programs in preventive maintenance. Specifically, in the March '65 issue there appeared an excellent article on the Navy's "Spectrometric Oil Analysis" program. Owing to our mission here, which is test and evaluation of aircraft gas turbine engines, the Spectrometric Oil Analysis program has been initiated on every engine that comes here for test.

As for the benefits we have received from this program, at least one engine was saved from a catastrophic failure in the lube system by early detection of an impending oil pump failure.

J. S. MARLOW
C.O., NAVAL AIR PROPULSION TEST CENTER

• Many thanks. We're pleased to be of service.

Essay and Poster Contests

FPO New York—During the months of April and May 1967 the VP-49 Safety Officer conducted an Essay Contest to obtain articles to submit to APPROACH magazine and to stimulate interest in aviation and ground safety. The contest was successful and prizes were awarded the authors of the three top articles.

Enclosure (1) is submitted as a guideline for other squadrons to follow to stimulate interest in their aviation safety programs.

LT C. R. PATY ASO, VP-49

• In addition to the essays, VP-49 also ran a safety poster contest along much the same lines. The two efforts produced a wealth of good material, some of which will eventually find its way into print by way of the magazine and the safety posters distributed to the fleet.

For ASOs and others who think that a similar program might increase the safety consciousness in their squadron, VP-49's guidelines are listed below.

Tips For Effective Writing

1. Write with directness, clarity and simplicity.
2. Make the article simple enough to read with ease and understanding by a poor reader and yet interesting enough to hold the attention of a good reader.
3. Define your purpose—get a specific safety message across.
4. Use words that will be understood—short, easy and common.
5. Use simple sentences—don't write in the same style you compose letters to headquarters.
6. Present your ideas in logical order—each part of your message should prepare your reader for what is to come.
7. Make your meaning complete—your story is not a dispatch message.
8. Use humor when it fits the issue—it will keep the reader's attention.
9. Assemble your ideas and make notes after turning them over in your mind for a few days.
10. Write the article in the rough, then set it aside for a few days. Go over the rough adding to or striking out parts of the article, as required.
11. Let a friend read the article and express his ideas and criticisms before putting the article in the smooth.
12. Give credit lines for sources which you reprint.

Contest Ideas

1. Ideas should be original.
2. Use photographs with captions, if at all possible.
3. Articles may be of a personal experience, technical nature, new safety procedures, ideas, or programs, etc.
4. Choose a title that will get the reader's attention.

Contest Rules

1. The article shall contribute to the promotion of SAFETY.
2. All personnel in VP-49 are eligible except the judges.
3. Articles should be between 1000 and 3500 words as a guideline.
4. Articles should be typed double spaced or written legibly.
5. The decision of the Judges is final.
6. Cash Prizes are: 1st—$50, 2nd—$35, 3rd—$20.
7. Articles will not be returned and become the property of the safety officer.
8. The articles will be submitted for publication in APPROACH and similar magazines.
9. The author's name will be used when published.
10. Submit articles to the Safety Office.

Vol 13 **approach** No 3

Our product is safety, our process is education and our profit is measured in the preservation of lives and equipment and increased mission readiness.

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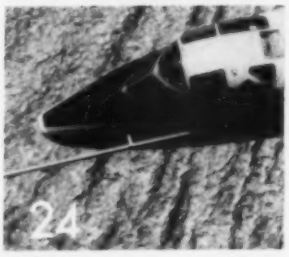

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CREDITS

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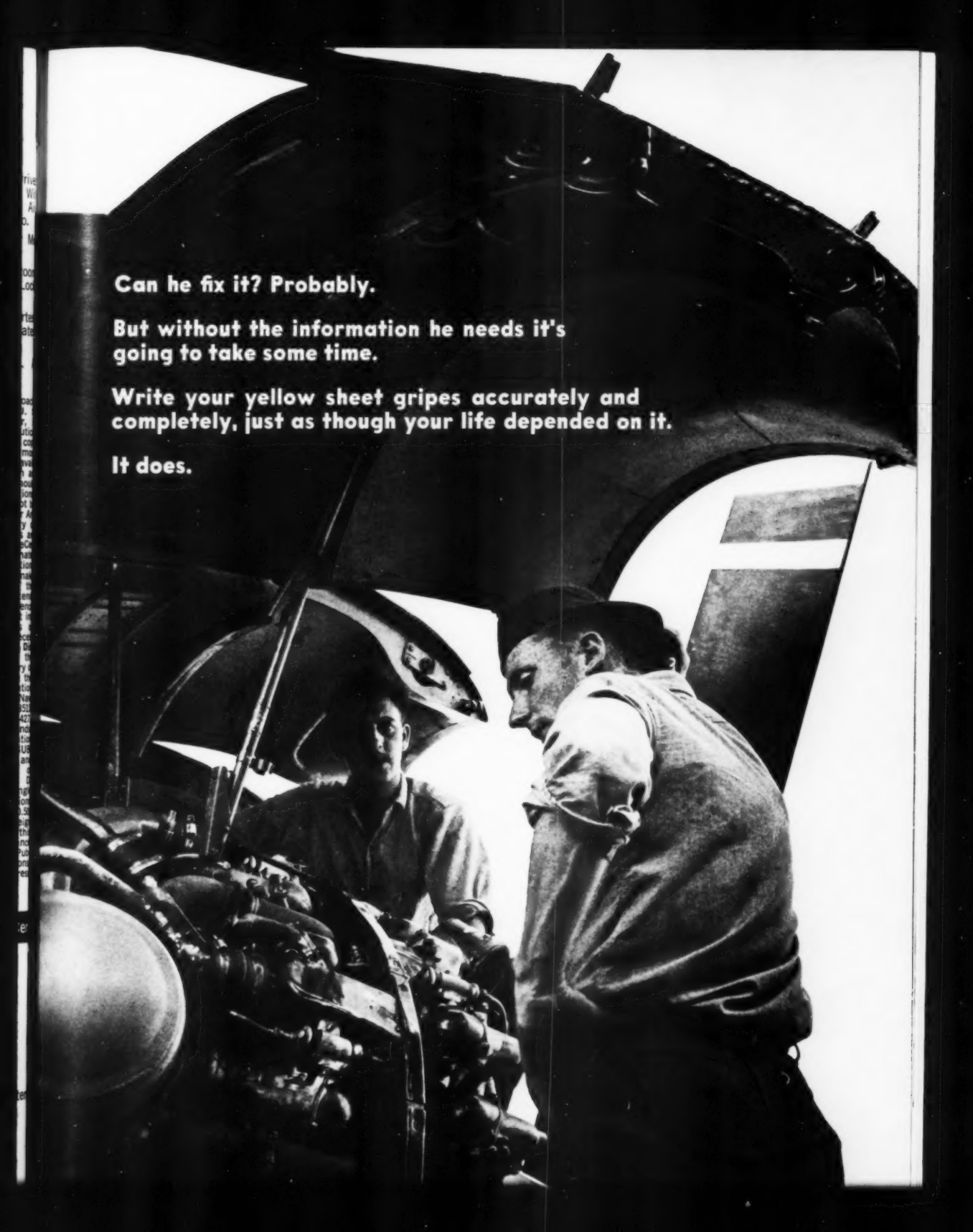
Can he fix it? Probably.
But without the information he needs it's going to take some time.
Write your yellow sheet gripes accurately and completely, just as though your life depended on it.
It does.

He stoops to conquer FOD

Do You?